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ABSTRACT

The declining emphasis on science, mathematics, and engineering education in the United States together with the necessity of the nation to ensure a continuous supply of trained practitioners in those fields was the consideration that prompted the conference reported in this document. The conference participants--who were representatives of the military, the government, industry, and academia, analyzed the potential of distance learning to deal with common educational problems and recommended a national initiative to implement distance learning in the United States. They also agreed that such an initiative would help to alleviate current global education and training problems. Seven presentations make up the major part of this publication: (1) "The Distance Learning Problem" (Andrew E. Andrews); (2) "Media" (John W. Keller); (3) "Interactivity" (Andrew E. Andrews); (4) "Instructional Strategies" (Mary S. Trainor); (5) "Collective Learning" (Andrew E. Andrews); (6) "Student Performance Evaluation" (Norman D. Hamer); and (7) "Implementation" (John Alexander). It is noted that the results of the conference demonstrated the need to begin leveraging technology to improve learning. A prologue describing the conference and summarizing the results of group discussions is also provided, as well as a brief epilogue, a list of conference participants, brief biographies of the presenters, and a 44-item bibliography. (DB)

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Distance Learning Conference Proceedings

Compiled by
John B. Alexander
Andrew E. Andrews
Norman D. Hamer
John W. Keller
Mary S. Trainor

IR014639

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

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An A-6 team effort produced the conference and these proceedings. The author identified following each major heading presented the topic at our conference and wrote the article. Conference participants spent hours brainstorming the issues, yielding volumes of information. To prepare these proceedings, small-group facilitators, note takers, and administrative staff reviewed and condensed the small- and large-group discussions. This staff included Ann Cernicek, John deVries, Jay Fries, David Hudson, Phyllis Idar, Carol Ann Martz, Liz Montoya, Jerome Morzinski, Linda Nonno, Jennifer Pratt, and Charles Thorn. I acknowledge their fine support in addition to the help provided by Steven Brown and Heidi Hahn to review the content of the material. Special thanks and recognition are in order for David Hudson and Carol Ann Martz. He provided the effort, enthusiasm, and dedication that made the actual conference a tremendous success. Subsequently, he and Carol Ann Martz had the task of ensuring that the documentation was complete. To both of them, thank you for a job well done.

Andrew E. Andrews
Group Leader
Cognitive Systems Engineering Group (A-6)

Contents

Acknowledgments	iv
Director's Statement	vii
Prologue	ix
Abstract	1
The Distance Learning Problem	3
Media	7
Interactivity	11
Instructional Strategies	17
Collective Learning	23
Student Performance Evaluation	31
Implementation	37
Epilogue	49
Biographies	50
Participants	51
Bibliography	53

Director's Statement

LANL Initiatives in Education

Siegfried S. Hecker, Director

Recent reports have indicated a declining emphasis on science, mathematics, and engineering education in the United States. In contrast, other industrialized nations are providing rigorous technical training for their youth. This situation presents a serious threat to the Department of Energy's (DOE) ability to maintain a supply of highly educated and trained scientists, engineers, and technicians to carry out DOE's mission in energy and defense research and development. To ensure the future economic competitiveness of this nation, we must strengthen our national technical competence.

Los Alamos National Laboratory's (LANL) interest in education is prompted by the necessity of our nation to provide a continuous supply of qualified scientists, engineers, and technicians. Therefore, I was pleased to have the Cognitive Systems Engineering (CSE) Group of the Analysis and Assessment Division host the Distance Learning Conference at the Inn of the Mountain Gods in Ruidoso, New Mexico, in October 1989.

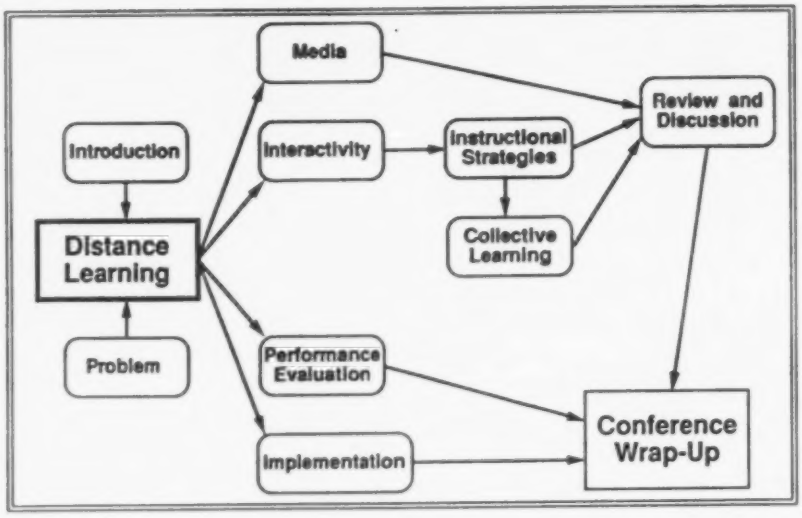
The strengths that the DOE laboratories bring to education are a wealth of unduplicated scientific resources and a collective experience with successful science education activities.

In the decades since the war, our primary mission has been to apply science and technology to national security problems, ranging from defense to energy research. The nation has expected the Laboratory to provide creative but practical solutions to complex problems. The results of the distance learning conference have demonstrated the need to begin *leveraging technology to improve learning* now.

Prologue

by Andrew E. Andrews

In October 1989, the Cognitive Systems Engineering Group of the Analysis and Assessment Division of the Los Alamos National Laboratory hosted a distance learning conference at the Inn of the Mountain Gods in Ruidoso, New Mexico. The conference participants–highly respected representatives of military, government, industry, and academia–analyzed **the potential of distance learning to deal with common educational problems**. The group explored the distance learning problem, media, interactivity, instructional strategies, collective learning, student performance evaluation, and implementation of a national distance learning strategy. The figure below illustrates the order in which the various conference topics were addressed.



The assembled participants scrutinized ways that **distance learning advocates could communicate the concept to the public**. They also sought acceptance of distance learning as a recognized, effective delivery system for enhancing current education and training systems and implementing lifelong learning strategies. Participants acknowledged that distance learning forces us to return to design and consider how technology can help us improve the status of education. The attendees agreed that **distance learning should be a national priority and could be applied to national problems at all levels**.

For the brainstorming sessions, the participants were arbitrarily assigned to four small groups (A, B, C, and D), which included people from varying disciplines. A two-column format has been used in each article to denote these small-group sessions, and the reader should not infer LANL endorsement of the material included. The small-group membership changed once during the conference.

The Cognitive Science Engineering Group members opened each large-group session with a brief presentation, the essence of which is included in the proceedings. The author is identified in each document, but readers should be aware that the conference participants and note takers in each session were responsible for the small-group session input and results.

These proceedings include not only the basic text of the presentations but also an account of the large- and small-group sessions. The individual session reports read more like log books than scholarly papers because they document what actually happened in the small-group sessions. A participant who has been conducting a distance learning project for many years said that by reading these proceedings, **you will learn more than you could by doing a year's worth of literature review.** This section summarizes the entire conference.

Background

The idea of holding a distance learning conference originated in March 1989. We identified potential participants (see page 51 for attendee list). We realized that without a national organization dedicated to distance learning, some experts would be missed. Subsequent to the conference, Michael Moore of Pennsylvania State University initiated the creation of such an organization.

The national education crisis encompasses declining standardized test performance, the number of functionally illiterate people in the nation, and a perceived apathy toward learning in general. In addition, a major concern prevails regarding rising educational costs. These expenses include the fixed costs of the institutions, the salaries of the teachers and administration, and the value of depreciable and expendable educational materials. In short, we need to raise the equality and quality of American education while limiting escalating costs. Therefore, distance learning is a potentially attractive alternative to supplement traditional forms of learning.

The Conference

The conference was held over a three-day period and followed a rigid, predetermined program. Attendees, other than Los Alamos participants, were not obligated to make advance preparations. This approach was taken to enhance participation in this first conference. Instead, Los Alamos personnel prepared remarks for each session to introduce topics for discussion. These remarks often contained premeditated, pejorative statements to stimulate debate.

For this conference, **distance learning was defined as learning that takes place without the physical presence of an instructor**. We felt a broad definition was important to preclude focusing on a specific medium. Indeed, based on their experiences, many participants arrived with narrower interpretations of distance learning, but they readily accepted the broader definition.

The Distance Learning Problem

The central theme to this discussion was distance learning. What problems can it help solve? What are the problems associated with effecting the solution? Small groups identified problems on a national level and within the educational, military, and industrial communities. The single, common theme was the necessity to instill a lifelong learning attitude or value. This point is significant because no group specifically addressed kindergarten through twelfth grade education, yet each identified a value that should be ingrained in those years. As a nation, we are entering an age of constant learning and changing technology.

At the national level, priorities were identified for the emergence of distance learning as a viable alternative to traditional classroom instruction. Distance learning causes the emergence of new concepts of educational and training institutions. If distance learning is to fulfill its potential, the nation needs to be enlightened about **all** distance learning technologies.

Among the education, military, and industrial groups, additional common themes emerged: to provide quality learning to physically and geographically dispersed personnel, to remotely access learning systems, and to instruct educators in new technologies and instructional strategies because of rapidly changing knowledge bases.

Media

The session acknowledged the importance of media as a vehicle for lesson presentation, interaction, and assessment. Generally, our ability to use the capacity of the media is the limiting factor in distance learning effectiveness, not the media itself.

Two questions were posed to the small groups. Both dealt with identifying the available media that are the most effective for distance learning and the new developments that can be anticipated in the future for specific media: print, audio/video, computer-based training, or synchronous telecommunications. The participants agreed that individual media cannot be assessed in isolation. Almost without exception, combinations of media are used to create a training system.

The difference between media and delivery was an issue among all groups. The distinction is further clouded by breaking media down into parts that represent, transmit, or produce lesson material. Although no one group reached clear insight or resolution, participants generally agreed that this problem warrants and requires further investigation.

Interactivity

Interactivity is a necessary condition for learning to occur. The learner must accept the information provided, process it, and internalize it. Motivation is closely linked to interactivity in the sense of intrinsic motivation of Herzberg's two-factor theory. Michael Moore's definition indicates that learning is a two-way interaction between the student and the teacher, the subject matter, and classmates. The small group expanded this definition to include media and tutors. Additionally, the participants suggested that some level of interactivity is needed in distance learning because people generally are not autonomous learners.

Consensus indicated that motivation and interactivity should continue to be treated as separate entities. However, the precise interrelation of motivation and interactivity is less important than acknowledging the relationship. Instead, it is more important to concentrate on creating high-quality interactivity that stimulates learning while addressing motivation separately.

New guidelines for distance learning interactivity are urgently needed. The distance learning paradigm is compatible with, but different from, traditional education. Therefore, distance learning developers, instructors, and teachers require different skills to be effective in distance learning. For example, one cannot place a classroom teacher before a TV camera and simply say "teach."

Instructional Strategies

An instructional strategy is the teaching method approach used to help students fulfill objectives. Traditionally, little emphasis has been placed on instructional strategies in distance learning; the focus instead has been on technology. Differing requirements demand appropriate strategies.

Instructional strategies include lecture, drill and practice, tutorial, gaming, simulation, coaching, dialogue, and collective learning. The last five strategies have rarely been used in distance learning. This session explored gaming, simulation, coaching, and dialogue, which require a computer for delivery and involve incorporation of the instructor's knowledge and skills into the computer software. Highlights of the discussion of the four strategies follow:

Gaming. Games are challenging to design from an instructional sense, but they can be very effective if designed well. They can stimulate not only high-cognitive-level learning but also collaborative work.

Simulation. In a simulation, the student manipulates a working model of the system being studied. Simulation is a very powerful strategy, especially for applications where safety is a

concern and the consequences of inadequate training are dire. High development and delivery costs were a concern, but recent technological advances are increasing design feasibility.

Coaching. Coaching involves active instructional intervention while the student is performing a task or solving a problem. Coaching focuses on diagnosis and correction of individual student misconceptions.

Dialogue. In dialogue, the instructor teaches by verbally guiding the student to new insights. For distance learning, the dialogue strategy could involve artificial intelligence. The discussion highlighted the need for instructor control as well as for student control.

The discussions initiated a thrust to emphasize strategy selection and the use of alternative strategies in distance learning.

Collective Learning

Collective learning is a pedagogical approach whereby students learn skills individually through group work. It is frequently referred to as collaborative learning. A review of the literature before the conference suggested that students learn better through non-competitive, collaborative group work than in classrooms that are highly individualized and competitive.

We examined collective learning at the conference to obtain a consensus that it is a valid and desired strategy to use in the distance learning environment and to explore how it can be implemented. Many distance learners are distant from not only the instructor but also from other students. In the traditional environment, a collective approach often occurs because students form unstructured study groups to work together in the learning process. While collective learning refers to a formal, structured instructional strategy, informal opportunities should not be ignored.

The conclusions of the work sessions did not provide any specific insight on structuring a collective learning environment except as an extension to current pedagogical approaches in the traditional environment. However, the group did conclude that the value of collective learning in the distance learning regime should be pursued with vigor to provide models for developers. While traditional instructional strategies focus primarily on instructor↔student interactions, collective learning concentrates on the student↔student interaction. This modification in the interaction paradigm changes the control function in the learning environment and needs to be fully developed to assure maximum effectiveness. The potential value of formal collective learning as well as the need for informal interaction among students suggests that networking opportunities should be available to distance learning.

Student Performance Evaluation

The issue of when a person has mastered a course or can be certified in a subject matter should be a major one in distance learning. In traditional education and training situations, the instructor can directly assess a student's abilities in real time. In distance learning, direct feedback situations may not exist. In many anecdotes about people taking distance learning courses, one hears about students' mastering the tests without actually understanding the content and about cases where people are frustrated by learning the material only to fail the evaluation procedure.

In response to evaluation scenarios, the small-group discussions reached the following conclusions:

1. Evaluation and certification through a distance learning system may or may not be appropriate depending on the subject matter to be tested and on the current state of technology. The main concern is for life-threatening operations.

2. Evaluation in a distance learning environment can use self-pacing, self-assessment, and more flexible scheduling. Evaluation by a distance learning system may become an economic necessity in certain situations.

3. A crucial issue deals with who will be responsible for testing and certification. Distance learning evaluation considerations that could affect the quality of distance learning include the following: Will those responsible for the actual development of a course be in charge of the final certification, or will some authority such as state or federal government take over the responsibility? Will course objectives and the testing process be coordinated? How will feedback and instructor↔student interaction be channeled if the certification process is separated from the teaching process?

Note that the major concerns expressed in the conference regarding the student performance evaluation problem were not in the construction of evaluation schemes, but in their administration, the appropriateness, and the general operation of any possible evaluation system.

Implementation

Consensus indicates that distance learning will play a greater role in future education while the traditional classroom or schoolhouse approach declines in popularity. Despite this fact, institutions are amazingly resistant to change and normally do so only when pressured by overwhelming external forces. However, on rare occasions, luminaries emerge who have both the foresight and the organizational ability to cause and direct dramatic change before the organization experiences the woes inflicted by those external forces.

We need a plan that overcomes obstacles and is so attractive to potential educators and their administrative decision makers that they will accept it. With finesse, this acceptance will convince educators that they originated the ideas. The challenge is to gain acceptance of distance learning and acknowledge the major contribution it can make to society.

Organizational change requires three entities: an identifiable product to which people can relate, proof of accomplishment, and, finally, organizational executive support.

What we need is a STRATEGIC EDUCATION INITIATIVE.

This feeling of urgency was at the heart of the group sentiment. In other words, we need a rebirth, a vision, a sense of going to the moon. Participants recognized a crisis in education, which is not new or unique, but reinforced by the combined experiences of this multifaceted group comprised of education, industry, military, and government representatives.

Although there is a perceived crisis, it is not considered an emergency. The problem is solvable, and many positive projects are already underway. What is required is a concerted effort to bring the resources of the nation to address this problem in a coordinated and focused way. There is a call to arms: the need for national-level leadership supported by grassroots efforts across the country.

The top leadership of the country, the president and key members of Congress, are already vocally supportive. Now is the time to press forward with initiatives and establish a ground swell that can capitalize on that hard-earned advantage.

Distance learning is not a panacea. Future efforts must be coordinated with traditional school systems that will continue to be the cornerstone of our basic education in America. The mission is to enhance, not compete with, existing institutions. Complementary roles will reduce the fear of change while providing for the needs of all sectors of our communities.

This conference demonstrated that education, industry, military, and government can and should work together in a cooperative effort to further the cause of distance learning. Implementation of the ideas proposed here requires that all participants fully employ the resources available to them, which include mobilization of a constituency to gain support at all levels. A steering committee will insure that the efforts started here do not die but rather are coordinated and disseminated to an even broader audience. Each must do his/her part to share ideas and to coordinate with others so that we can articulate and reach a common goal. Distance learning is part of the solution to the education crisis, but it is **not** the whole solution. We are part of that solution.

Conclusions

Distance learning has the potential to provide an opportunity for lifelong learning, which could solve global education problems. Although distance learning can be part of the solution to the educational crisis, obstacles include resistance to change, traditional views of education, and costs. It is crucial that a formal architecture be developed for distance learning in the context of the present-day education crisis.

Implementation of distance learning is a key issue. The successful implementation of distance learning depends on several actions.

- **Document benefits**. We must document any existing implementations immediately to expose objective evaluations of the advantages of distance learning. Distance learning requires many resources and must be supported by convincing evidence that it is, in fact, a viable solution.

- **Evaluate the costs**. What are the costs of development and delivery? How can they be met?

- **Create a cultural change**. The expectations engendered by schoolhouse teaching traditions must be replaced with anticipation of innovation. We must design a new metaphor for education rather than simply implement old ideas with new technology.

- **Learn from the foreign experience**. Distance learning is producing results in many other countries right now. We should take advantage of their experience.

- **Locate the control of distance learning**. Where should the locus of control reside (in the instructor, in the certifying body, in the local government, or in the federal government)?

- **Promote a multidimensional constituency**. Academia, the military, the government, industry, the public schools, and the community must all contribute to the effort to ensure success.

- **Seek national support**. It is unlikely that the potential of distance learning will be realized without federal support in addition to other (state, city, local, etc.) support.

We need a plan, a focus, and national leadership immediately. Distance learning can be a part of the solution to the education crisis in the U.S. if we can successfully surmount obstacles such as resistance to change, traditional views, and costs. The enthusiasm of distance learning proponents and the "think tank" environment of conferences, like the one sponsored by Los Alamos National Laboratory, can unify efforts leading to implementation and, perhaps, even effect a national initiative.

DISTANCE LEARNING CONFERENCE PROCEEDINGS

Compiled by

John B. Alexander, Andrew E. Andrews, Norman D. Hamer,
John W. Keller, and Mary S. Trainor

ABSTRACT

This document reflects the content of the Distance Learning Conference sponsored by the Cognitive Systems Engineering Group, Analysis and Assessment Division, Los Alamos National Laboratory. The conference participants–highly respected representatives of military/government, industry, and academia–analyzed the potential of distance learning to deal with common educational problems. The group explored the distance learning problem, media, interactivity, instructional strategies, collective learning, student performance evaluation, and implementation of a national distance learning strategy. The conferees mandated a national initiative to implement distance learning in our country. Such a focused effort may help alleviate the current global education and training crisis.

The Distance Learning Problem

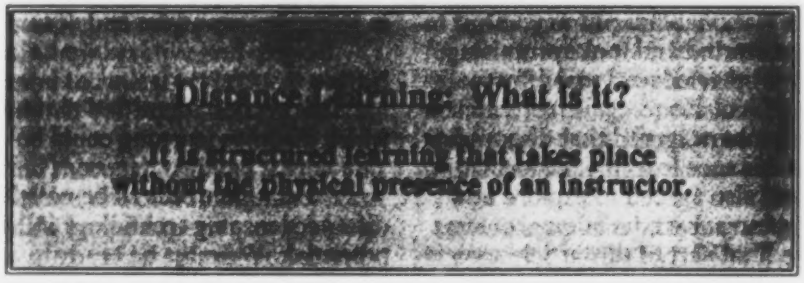
by Andrew E. Andrews

Background

The principal focus was to determine what must be done to make distance learning a preferred solution to educational, military, national, and industrial training/education problems and to determine how to implement the solution. The participants were challenged to define the problem(s), guided by the conference tenet of being requirements driven.

Assumptions

We assumed that the participants at the conference were distance learning advocates. Therefore, we expected the results to represent an advocacy position. We also assumed that the group basically agreed with the distance learning definition shown in the figure below.



Question

From the perspectives of education, military, nation, and industry, what are the true problems for which distance learning is a solution or requirement? Are there similarities? What should the priorities be? **Specific examples listed in the paragraphs below are not mutually exclusive.** They reflect participants' input.

Education

This group discussed the unique issues that education has with respect to distance learning. Highlights of this session are listed below:

- Public education is in the news.
- The Presidential Education Conference has met to air the educational concerns of the country.
- The military has implemented a great deal of distance learning and may have some solutions that would be useful to the rest of the country.
- Adult education at Syracuse University has been studied, and many ideas on distance learning resulted.
- Public relations at the University of the World, La Jolla, California, are implemented with distance learning, which seems to be effective.
- Many user/human interaction research activities being performed by the military may impact the distance learning problem.
- PM TRADE (a U.S. Army organization and training program manager located in Orlando, Florida) is using embedded training in many of the research and development (R&D) models currently under design.
- The U.S. Navy is using distance learning in its education and training.

- The instructional systems design (ISD) costs for distance learning are high.
- Industry is facing a very tough problem in recruiting literate workers from the American population.
- Recent high-technology developments have created unique problems, which may be solved using distance learning.
- Oklahoma State University distance learning has demonstrated a large-scale distance learning effort for training purposes using satellites and closed-circuit TV to reach the entire state's National Guard force. This effort has just started and looks promising as a model for other educational efforts.

The group members agreed that discovering and defining the distance learning problem were essential and also agreed to explore how distance learning can solve education problems. The figure in the final part of this article summarizes the current problems in education as prioritized by this group.

Military

A number of issues were identified for implementation of distance learning in the military. Current instructional strategies are inconsistent in providing quality training to both Active and Reserve components. The instruction lacks congruency. A vast array of subject matter needs to be taught. Some material is applicable to distance learning techniques, and some material is not. Many Reservists require training, are widely scattered, and have only limited time available for training. In the Active Component, a relatively high personnel turnover rate exists, which generates the necessity for a continual training effort.

Large numbers of personnel need to be trained. For example, the Army's Training and Doctrine Command (TRADOC) alone trains 450,000 people per year. Managing such a significant program is very difficult. Military units are distributed worldwide. Many relevant training subjects apply to only a small number of personnel at each site.

Senior management is perceived as being slow to accept new ideas as a result of their being educated in a centralized system. The services may resist new ideas from outside the military. Interoperability among American and international military services is essential, which means that individuals must be able to cooperate to execute joint missions. In addition, dissimilar units must be able to function together.

The services need to standardize many functions. However, establishing standards is often difficult. Once in place, distance learning would provide standardized training.

The group prioritized the issues as reflected in the summary at the end of this article.

Nation

This session identified national issues for which distance learning could be a solution.

The nation needs to be enlightened about distance learning technology if it is to fulfill its potential. We must be ready to accept new concepts of education for distance learning to be endorsed and implemented. The lifelong learning attitudes of people will be changed by the concept of distance learning. We are entering an age of constant learning and retraining.

Nationally, we can develop programs and new learning communities to educate a larger student population more efficiently. New self-help communities are already developing in some areas and can be expanded. In addition, we can tap unused resources, such as retired people with expertise.

Distance learning will also permit us to emerge from our national shell into a world of global knowledge. As a result of our nation's developing a global understanding, distance learning will be able to reach more people with significant issues, such as the worldwide destruction of the environment. Information concerning health and social issues, such as AIDS, famine, and injustice, can be readily disseminated. Global distance learning would then embrace language and cultural barriers.

The participant consensus indicated the priorities for the nation as shown in the summary chart in the final section of this article.

Industry

This small group was tasked to identify distance learning problems relative to industry. In this initial session, the group had difficulty focusing on the priorities for industry. However, throughout the industry discussion, participants agreed that cost underlies all issues.

How one motivates or gets others involved is a constraint. Motivation is fundamental to any training, but it is especially critical in the distance learning environment. In the corporate sector, a "buy in" is essential.

The standardization of information is important. For example, management planning and procedures, administrative and clerical tasks, and common technical procedures can be standardized.

Adequate and thorough training is vital and requires the effective use of training resources. We must capitalize on the experience of widely dispersed experts, instructors, facilitators, and certifiers. Auto mechanic training is an example. If the mechanics are perplexed, they can consult industry experts. Currently, the communication is from experts to novices rather than the reverse.

Industry has common training requirements that need to be met by a large group of people. Distance learning could alleviate the need to send many trainees to training centers, and could also standardize the content. In cases where requirements are common among companies, a single training system could be available to all requiring training.

The need for training occurs *ad hoc* and usually must be satisfied in a short period of time, yet not everyone needs the same amount of training at the same time. It is not necessary for new hires to wait for the next training class when it is being implemented by some form of distance learning. Specialized training, retraining, and certification can also be accomplished in this manner.

The issue of continuing education is also important to industry. Distance learning can provide personal, as well as professional, continuing education to meet changing requirements.

Summary

The most significant similarity among the results of all the small-group brainstorming sessions and prioritizing tasks was the emphasis on rapid technological changes, which have led to changes in the labor pool. For example, the military must train mechanics on the newest trucks, but the personnel may be transferred to another base where they may need to service old vehicles with which they are not familiar.

A common, significant issue was accountability, making organizations (management) accountable for delivering quality training. Other dominant issues were how well facilitators are teaching, how appropriate the teaching/training is, and how students are motivated. For example, the Army has field exercises for evaluation; they also have teams that evaluate the training and then revise it when appropriate. Would distributive learning be feasible?

The issue of continuing education was universal. Information dissemination was an issue common to the industry, military, and nation groups. Consistency in training was a recurring theme. Distance learning implies centralized development and delivery of training, which was common to all groups except the nation group.

How can one deliver consistent, quality teaching? In distance learning, without a teacher present, students have more frequent opportunities to interact with each other about the teaching than in a conventional classroom. Distance learning requires increased creativity on the part of the teacher.

The language/cultural barrier concern was shared by the nation and industry groups.

The education group had many issues in common with the industry group, for example, geographical and physical issues, optimization of learning, continuing education, and keeping pace with technology changes.

Priorities Established by the Small-Group Sessions

[illegible]	Industry*	Military	Education
1. Awareness of distance learning technology	Motivation	Quantity and quality of new personnel	Geographic access to education
2. New concepts of institutions	Geographic dispersion, non-homogeneous population	Inconsistent instructional strategies	Educator training
3. Lifelong learning attitude	Standardization/ consistency	Rapid technological change	Optimization of learning
4. Global knowledge	Content	Global training requirements	Learning continuing education skills
5. Environmental issues	Specialization	Management ▪ scope of training ▪ turnover ▪ interoperability ▪ cost	Adaptation to rapidly changing knowledge
6. Language/cultural barrier	Effective use of training resources	Interoperability	
7. Information dissemination	Variable *(ad hoc)* training requirements	Transition from R&D to implementation	
8. Inclusion of marginal members of society	Continuing education		
9. Self-help communities			
10. Consensus	***Cost underlies all priorities!**		

References

Note: A binder that was available to conference attendees provided a number of distance learning publications. A copy of the bibliography of these publications is provided in the proceedings as a resource.

Media

by John W. Keller

Background

The media session allowed each conference member to make input on media and also provided a base from which to progress to the remainder of the conference. Thereafter, when any issues of media emerged during the other sessions, we were able to refer to the results of this session. We wanted to prevent further discussions of specific media during other sessions.

The design of instruction for distance education has been driven by technology. An organization started with its available media and then designed instruction based on them. The issue addressed in this conference session was the potential of each existing medium for a given type of distance learning in terms of instructional strategies. This approach facilitated the selection of the most appropriate medium. The media selected for in-depth discussions were audio/video, print, computer-based training (CBT), and synchronous telecommunications.

Because media should not be the driving factor in the design of a program, we need to decide where media belong. We must always keep the available media in mind while designing an effective distance education course. In addition, to select an appropriate medium, we must have information on available media. It might also help if we had an idea of what media will be possible in the future and with what types of distance education they will be most compatible. Such knowledge would help us reduce the temporal gap between technology and its use.

Our ability to exploit a technology significantly fails to keep pace with the technology itself. Software is generally ten years behind the technology it supports. This situation also exists with distance education. The technology is advancing so rapidly that the effective uses of the technology for instruction fall behind. How are we to reduce the gap between technology and its application for distance education?

Another factor that we must consider is distribution. All forms of media must be distributed in some way. We did not want to debate whether or not a television is its own distribution system. Rather, distribution refers to the whole system that is behind the television. Distribution is important because our ability to transmit material is constrained not only by the capacity of the media but also by their distribution methods.

". . . trying to be at the leading edge of technology rather than at the bleeding edge."

Assumptions

- Media are the backbone of communication in distance learning.
- Media can influence learning effectiveness.
- Ultimately, all instructional material must be transmitted in a form that stimulates one or more of the senses.

Questions

1. Which of the available media are the most effective for distance education?
2. What new media can be expected in the future?

Audio/Video

The goal here was to determine what audio/video media were available for distance learning and what would be expected in the future. Although the individual media were addressed separately, it was noted that is rarely the way they are employed. Most distance learning applications are comprised of several different media, which fulfill different requirements within the system.

Many of the existing technologies do not speed interaction. However, controlled interaction might be the most desirable. The quick answer is not always the best. If one must mail questions, the response time is too slow. The quality of the feedback is an important issue.

While it was determined that each of the media was capable of supporting all cognitive levels, it was pointed out that in some cases the costs would be very high. Tradeoffs in cost and effectiveness would need to be evaluated on a case by case basis.

The future work place will demand higher cognitive control of the educational process, requiring nonlinear capability so that the student can move freely within the lesson and adjust the level of instruction to his or her specific needs. Clearly, fully integrated technologies will be required. Additionally, students will need direct access to archived information for problem solving and will not be restricted to existing lesson formats.

The following matrix is an elaboration of one found in *Training for Tomorrow* (Kearsley 1985). It lists the media that were discussed within the audio/video category. Each category was developed by the participants to show the potential for each medium.

Audio/Video

Category	Feedback & Interaction	Sense(s) Used	Distribution Method	Cognitive Level	Dominant Cost Factors	Future Enhancements
[illegible]	Long	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Full Production Television	Long	Audio/ Video	Synchronous	All	Production, Distribution, Instructional Design (high)	Search Interactive Mode, Index for Non-Linear Capability
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Audio Live (Two-Way)	Variable Student-Controlled	Audio	Electronic Mail	All	Distribution (low)	Audiographics, Global Access, High Motivation
[illegible]	Long	Audio	Mail	All	Production/Instructional Design (low)	[illegible]
Future	• Integration of media • Learner access to archives • Fiber optic network availability			• Location change • Non-linear presentation		

Print

The group defined print as anything that can be printed on paper and stated that printed material presupposes some level of reading skills. The role of print is to exchange information in an informal dialogue.

Because of the literacy problems in the country today, some graphics capabilities must also be included to accommodate marginal readers.

Print has several advantages. It allows for the personalization of the material by making notes in the margins and by highlighting text. By mapping the new material into our own current knowledge base, this customization of the learning style is a memory aid. Writing down information also allows for a gestation period and integration at a later time.

The first issue that emerged concerned the distribution methods that print media employ. Print is easy to transport or distribute to any learning or job site. However, this distribution method does not allow for evaluation, discussion, or feedback because mailing questions and answers back and forth is too slow.

Using computers as the distribution method is an option. The material can be printed out on a printer for those who dislike reading text from a video display terminal, and interaction can take place faster via E-mail (electronic mail). Using facsimile machines permits fast transfer of printed material and handwritten notes. However, questions of honesty and personal integrity linger.

The participants agreed that print will probably persist. Future print media will continue to be enhanced by computerized information storage and retrieval technology.

"Technology has advanced to the point where we may almost dictate our needs and get what we want."

Computer-Based Training

Today's CBT systems have advanced a step beyond the electronic page turners, provide immediate feedback to the students, and allow for control of the learning process. Modern CBT design models are better able to diagnose a student's progress and needs, and they promote risk taking because the students ask more "dumb" questions of a computer than they do human instructors. Intelligent tutoring systems are good vehicles for achieving such flexibility.

Nevertheless, these intelligent systems have not really been adopted yet. Intelligent tutoring and expert systems do work well for limited knowledge domains but still are not sufficiently general for widespread use. In many cases, the instructor must still interact with the student, which is especially true in cases where some remediation is necessary. Even though these systems ideally will stand alone, it is hard to envision a system that is designed so well that it can handle any question or eventuality that might arise.

"What is (or will be) the function of the human being in the future of distance learning?"

One component of CBT that was discussed is computer control of authoring. A performance content method can be used to construct CBT. Lesson templates are used, each keyed to a particular cognitive function, and the teaching is aimed at certain levels of mastery or performance. The up-front costs are high because the templates must be designed very well because of the cookie cutter or cookbook strategy that this employs. This authoring tool helps to get a product out quickly and cheaply.

Throughout the discussion, the group found it very difficult to deal with CBT as a specific media because it encompasses so many types of systems. They determined that it is not really a medium. The distinction between a medium and a distribution method is especially difficult to define for CBT. It is a combination of method and media but more than either. The group determined that the term *computer-mediated training* is more appropriate. This term emphasizes that computers are endemic to media/transmission means.

In the future, CBT systems will do a better job of modeling the student's learning process and customizing training to those processes. There will be development systems for analysis,

design, and implementation of training systems. Furthermore, the training will have to become embedded in the system so that it is transparent to the learner. Playing and learning will become the same thing.

Synchronous Telecommunications

A telecommunications medium is synchronous when there is immediate feedback (question followed by answer) to the student. These media include, but are not restricted to, videotext, video conference, and computer conference. This group assumed that its model was not limited to instructor and student(s). In the case of videotext, the model is computer and student.

In any set of criteria for selecting a medium, a cost benefit analysis is necessary. Knowing the dominant cost factor is not enough. Especially in the business world, it is necessary to assess what the return on the investment will be. Most of the enhancements to technology that we discussed involved increased cost effectiveness.

Interactivity increases as the medium approaches emulating a face-to-face conference. Although synchronous telecommunication does not permit every element of a true face-to-face (lacks the sixth sense) situation, it is a medium that allows a high level of interactivity. The group also determined that two-way audio/video is probably most effective when used in the middle- to high-cognitive levels, but the level of interactivity will decrease as the number of students and/or sites increases.

"We are still not good at using and managing technology for our needs."

Under what circumstances is it necessary to have this level of interaction? The answer given was that it would be any situation in which the participants needed to view the same dynamic piece of information simultaneously or any situation in which the instructor needs to interact directly with a student (for example, teaching motor skills like ice skating).

Summary

Individual media cannot be assessed in isolation. Almost without exception, combinations of media are used to create a training system. Therefore, an effective way to address media would be to examine combinations of media. Which combinations work the best for given educational requirements?

The difference between media and delivery was another issue among all the groups. The distinction can be clouded even further by breaking it down into the parts that represent, transmit, or produce lesson material. Although no one group developed a clear insight or proposed a specific resolution, the participants generally agreed that this problem warrants and requires further investigation.

A greater level of learner control was also a common theme. Students should be able to control the level of interactivity and the educational process to meet their needs. A large and growing amount of archived material is available, and the learner must be able to access and retrieve some of this material. Fully integrated technologies will be required for these needs to be fulfilled.

We tend to apply technology to the things we have always done in the past, simply using a new tool in an old way. New strategies must emerge that effectively use the new technologies. For example, in what ways can these strategies be used to achieve more effective instruction using the higher levels of Bloom's taxonomy?

Reference

Kearsley, Greg, *Training for Tomorrow* (Addison-Wesley Publishing Company, Inc., Reading, Massachusetts, 1985), p. 106.

Interactivity

by Andrew E. Andrews

General Overview for the Next Three Sessions

The next three sessions dealt with motivating students to learn. In any instructional environment, students are motivated for a variety of reasons, which can be categorized in two ways. First, minimal performance expectations are linked to students' personal goals. For example, meeting a specified level of training may be required to meet job qualifications. In a sense, these motivators are a form of negative leadership: perform or else! Generally, these forms of motivation are easily established, but they guarantee only a minimal level of performance.

The second set of motivators stimulates students to excel. Usually, these motivators are intangible and often reflect the leadership of an outstanding teacher. However, distance learning reduces instructor contact. Instead, the medium for communication tends to be impersonal, at least on the surface. Yet, if distance learning is to be universally successful in contributing to a better-educated and more-capable population, it must stimulate higher student achievement.

In the sessions that followed, the conference addressed the three areas that have the greatest potential for positive motivation–interactivity, instructional strategies, and collective learning. In all of these discussions, the participants were asked to concentrate on the **metaidea** of positive motivation for the learner.

Background

Learning requires interactivity. The learner must accept the information provided, process it, and internalize it. Furthermore, the instructor requires feedback from the student to adjust instructional strategies, apply remediation, and respond with encouragement that is intrinsically motivating. In the distance learning environment, print, audio, graphics, and video are available technical tools. Through various communication systems, **students and instructors** and **students and students** can converse. Also, students interact with the instructional content; sometimes the instructor is a machine. The issue is to establish standards for interactivity, guidelines for achieving it, and requisite skills for distance learning faculty with respect to interactivity.

[Note that inculcating a desire for lifelong learning was not discussed. This subject, perhaps without consideration of interactivity, needs to be addressed and will be a topic in a future distance learning conference with the more restricted view of determining if distance learning can provide the motivation for lifelong learning.]

What level of motivation (how much intrinsic motivation through interaction) is distance learning obligated to provide?

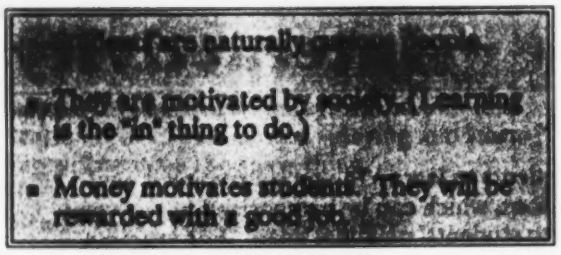
The group had difficulty with the notion that distance learning should be **intrinsically** motivating. They questioned the assumption that interactivity provides motivation. Accordingly, they restated the question to ask what type of motivation distance learning is obligated to provide.

"We don't do a lot of training because it's fun to do or take a job that doesn't pay."

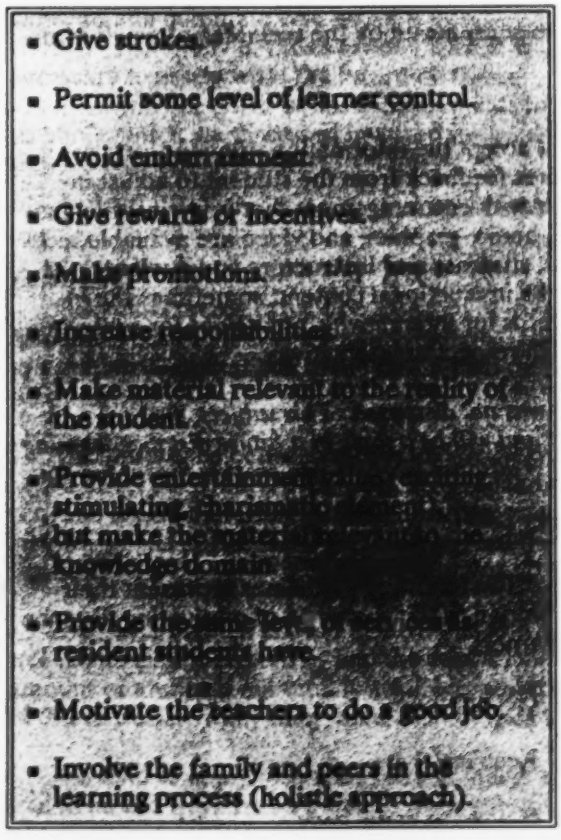
The following guidelines represent their solution to the challenge of motivating distance learners.

- Get'em there.
- Keep'em there.
- Get'em to come back.

They characterized students in the next chart.


They are motivated by society. (Learning is the "in" thing to do.)
Money motivates students. They will be rewarded with a good job.

Intrinsic and extrinsic motivation must be differentiated. We should examine the characteristics of motivated learners (age, relevance of material, cultural history, language, interest level of material, and control of learning situation). Finally, they identified the following principles for motivation that should be considered in distance learning.



The group also felt that instructors need motivation. One group member pointed out that the instructor has the responsibility to create an environment that encourages learning.

What are the guidelines for interactivity and/or how should they be established?

This group wrestled with the task of identifying guidelines for interactivity in distance learning and/or how to establish them. The discussion focused on identification but did not formulate conclusive guidelines. Nevertheless, some insightful observations are listed below:

1. Good practice suggests moving toward intrinsic motivation.

2. If the student is allowed to select the level of interaction, guidelines for interactivity may not be necessary. (Note that the difficulty of permitting each student to select his/her level of interactivity was not discussed.)

3. Options must be incorporated that recognize different learning styles.

4. Distance learning slows down the interaction enough to promote a higher level of interaction from reflective learners.

5. In the future, cost, benefits, and fidelity levels must be considered.

Additionally, the group looked at interaction with respect to Moore's model of interactivity (Moore 1989). They suggested a progressive series of questions:

- Is learner↔content enough?
- If not, is learner↔instructor needed?
- If that interaction is still not enough, how about learner↔learner?

The level of interaction can be increased as needed if at some point learner↔content interaction fails and the performance suffers.

What could be some guidelines for achieving interactivity through primary media?

The discussion in this group centered on two areas that we can roughly term as media-affected interactivity and environment-affected interactivity.

Under the umbrella of media-affected interactivity, we include concepts that deal directly with the hard presentation of the learning system: course structure, video presentation, scripting, etc. All agreed that good design was extremely critical. Design can compensate for many hardware limitations, but unlimited hardware and production will have little effectiveness if the overall design is poor. Knowing the audience is critical in distance learning. One should avoid obvious blunders such as cultural taboos and meaningless analogies. In addition, every effort should be made to involve students in courses from the start. Caution should be exercised to eliminate technology anxiety if the course is using the latest methodologies.

It is also helpful to make the lesson material nonjudgmental. Early success reinforces and encourages students to persevere and seek further education.

Whatever the media, proper care in developing a "good story" with drama and suspense can do much to integrate the student and compensate for not having the latest hardware. Further, the greatest technology can never overcome a poorly planned and scripted course. Video presentations must be comparable to those seen on commercial television because people have come to expect such a production and are disappointed by anything less, which does not mean that the video screen should be cluttered with details and minute realism. On the contrary, if a screen is too busy attempting to achieve lifelike fidelity, it can be distracting.

Presentations should be kept as simple as possible to avoid distracting cognitive overload. Creative design can create the illusion of reality without the expense or overload of a full-blown simulation. **Simplicity and good design should be the standards**.

Regarding the second type of motivation mentioned above, we refer more to an atmosphere or attitude rather than to the technology that we have just discussed. Here we consider that motivation and extrinsic rewards create greater interactivity and learning. The group noted that motivation and interactivity have a circular relationship of induced reinforcement.

Fostering a sense of community within the students generates a great deal of interactivity. Course material development can create such teamwork and interdependence among the students. It is important to make each student feel a responsibility to the group, that is, that they are needed and must support the success of the group. The sense of community and bonding among students will encourage increased effort by each student. In addition, instructor feedback will always be important to the atmosphere provided.

What are the requisite skills for distance learning faculty with respect to interactivity?

Faculty skills include those used by instructors, designers, content experts, tutors, facilitators, proctors, and supervisors. Anytime the term *instructor* is used, it refers to the person that delivers the actual material by a medium that supports this delivery method.

There are also several types of interaction: **student↔material**, **student↔instructor**, and **student↔student**. Generally, we are concerned with the interaction between the student and the instructor.

For the most part, it seems that the requirements for good distance learning faculty are an enhanced version of the skills found in good instructors from traditional learning plus some media-specific requirements. Some creativity is required because the planning and management of distance education need to be better than those that are generally found in traditional formats. It will not be sufficient to have instructors that can just "tap dance through the material."

Faculty must be able to deal with the lack of feedback from students. Teachers are accustomed to using student feedback to motivate them and to enhance instruction. Distance educators may have to learn to live without these incentives. Faculty may have to be able to teach the students how to learn effectively,

using the new environment of distance education. Many media-specific requirements will also be needed. The faculty must deal with new student learning strategies through different media. For example, in various cultural regions of Alaska, students have learned different ways to respond to questions. In one area, they have been taught to think about their answers carefully before responding. In another, students reply immediately even if they do not have a well-considered answer. An instructor using two-way audio needs to be able to deal with complete silence across the line while students think about answers.

When using both audio and video, it is common for inexperienced instructors to neglect the remote learners. The instructor must know how to encourage interaction from the remote group. When using two-way audio, additional listening skills are required because of the lack of visual clues. In many cases, faculty must be able to communicate effectively through written material.

Summary

In the ensuing large-group discussion, there was a distinct focus on interactivity and media. With the caveat that distance learning should/can be entertaining but should not be entertainment, participants agreed that much can be learned from commercial television, the cinema, and the advertising community with respect to interactivity. Furthermore, we should not be simply trying to duplicate the traditional classroom. We must leverage the technology to do what it does best.

Good course design is critical and can offset hardware limitations. Distance learning forces us to return to design and determine how we can improve on what we have in place. The best technology can never compensate for a poorly planned and scripted course. Because technology has advanced to the point where we may almost dictate our needs and get what we want, instructional material must be sensitive to the times. For current technology to enhance and encourage distance learning, the courses must be interesting and well planned.

A fine line exists between entertainment value and educational value of the media. Therefore, instructors must know their audiences. Learning materials must have exciting, stimulating, entertaining, and charismatic elements, but they must also be relevant to the knowledge domain. Madison Avenue and commercial television can teach us a great deal, but we must not lose sight of our educational objectives. On the other hand, instructors must create some excitement or they will fail on television/video.

We focused on instructors, noting that simply giving instructors more to do or expecting them to acquire a greater inventory of skills will not work. Distance learning requires a faculty team, forcing a return to design and an assessment of how technology can help improve instruction. However, we must not let technology drive the course.

Student-to-student interaction is crucial to good learning, and we also focused on interactions between the students and the instructor. Faculty must be able to deal with lack of feedback from students. Teachers are accustomed to capitalizing on student feedback to guide their instruction or to internalize feedback for their own motivation.

Positive interactivity can be generated by developing a sense of community among the students. One strategy for encouraging interactivity is to develop course material to support teamwork and interdependence among the students. Each student must feel a responsibility to the group–a feeling of being needed and being essential to the success of the group. Such a sense of community and bonding among students will foster more concerted effort by each student.

learning. Motivation and interactivity have a circular reinforcement relationship for both the instructors and the students.

"Try to make knowledge interesting. It is the currency of our times."

One must consider the backgrounds of the students. Cognitive style (external versus internal locus of control and reflective versus impulsive) is very important and not linked to autonomy. In traditional classrooms, impulsive thinkers are rewarded. In a distance education environment, reflective thinkers can interact at a higher level because interactions are slowed down enough for them. Some learning-disabled students can tolerate only a nonstructured environment, yet others cannot. Distance learning may demand a greater amount of adaptability than conventional instruction, and this adaptability will be essential because courseware has to accommodate all types of thinking.

Motivation is inherent in interactivity. Characteristics that motivate people, both young and old, need to be identified. Motivating the teacher as well as students is a critical issue; thus, if the teacher can be motivated, student motivation logically follows. Early student success is critical to reinforcement, committing the student to a class and motivating the student to seek further success in education. Students' enthusiasm for the course material, in turn, motivates the instructor.

Reference

Moore, Michael G., "Three Types of Interaction," in *Readings in Principles of Distance Education* 1, M. G. Moore and G. C. Clark, Eds., 100-105 (1989).

Instructional Strategies

by Mary S. Trainor

Background

Interactivity guidelines set the stage for a course, but one must determine the pedagogical approach or instructional strategy for applying these guidelines to the design. Many different taxonomies for such strategies exist in the education literature, but these taxonomies cover the same content. The strategies range from expository (lecture) to tutorial (present information and then ask questions) to simulation and Socratic dialogue. The level of interactivity in these strategies varies in quality and frequency of interactivity. Most courses of instruction use several instructional strategies to meet the needs of the students and the subject matter.

This session explored alternative distance learning instructional strategies, with the goal of increasing the potential for learning effectiveness. The taxonomy for instructional strategies selected for the conference is below. These strategies are presented in sequence from the least interactive to the most interactive.

Instructional Strategies

A Range of Choices for Distance Learning

Lecture: *The one-way presentation of information from an instructor to students.*

Drill and Practice: *Exercises to ensure incorporation of facts and procedures.*

Tutorial: *Material presented and questions asked.*

Games: *Any contest among adversaries operating under rules for an objective (winning, payoff). The adversary may be a computer or another person.*

Simulation: *A working model (imitation) of the targeted system given to the student to manipulate and observe. This model may be physical, procedural, situational, or process in nature. Learning occurs by performing activities in a context similar to the real world.*

Coaching: *Instructional intervention given while a student is performing a task or solving a problem. The intervention is specific to the type of error the student has just made.*

Dialogue: *Questions for the student by a human or a computer. Dialogue provides highly tailored feedback and then branches to a new topic or remediation depending upon the student's response. Some intelligent tutoring systems are examples of computer-based dialogues.*

Collective Learning: *A process or situation in which students cooperate in exploring a given area of study or in solving a problem.*

The potential for analysis and synthesis learning experiences is higher in the dialogue strategy than it is in the drill and practice strategy. Obviously, this is a broad generalization for which many counter examples can be made, but it is a useful paradigm for planning curricula. At the beginning

of a new module during which new knowledge must be acquired, exposition and drill and practice might be good initial strategies, followed by simulation and then collective learning exercises. Dialogue and collective learning strategies, for example, are not optimal strategies for presenting new facts and procedures.

Several instructional strategies have not been used to any great extent in distance learning. Because of new advances in technology, these strategies (for example, games and simulation) can now be used. As a result of extensive educational research, educators have capitalized on video and computer games (for example, Ellington *et al.* 1981; Malone 1980; and Nawrocki and Winner 1983). This research has revealed the design challenges required to make a game both motivating and instructional. Distance learning presents new challenges for the instructor/designer when selecting instructional strategies. Therefore, the distance learning community needs to provide guidelines for selecting and using instructional strategies, in particular, those that have not been adequately exploited.

Rationale

Traditionally, little emphasis has been placed on distance learning instructional strategies. Instead, the medium is selected, and then the instruction is written, based on the capabilities of the medium. The focus has been on technology at the expense of instructional strategies. This approach can produce the following undesirable results:

- Unmet training requirements,
- Cognitive-level mismatch,
- Use of instructional strategies not compatible with student requirements, or
- Lack of variety in media used for a course.

Frequently, an instructor fixates on one successful and familiar instructional strategy, but that particular strategy may not be the best match for the student population, the subject matter, or the course objectives. This situation can result in unmotivated students and/or students who complete the course, having achieved different objectives than those expected.

Alternative Strategies

At the conference, the instructional strategy question for small groups focused on in-depth development of individual strategies that have been unexploited in distance learning. The strategies explored were games, simulation, coaching, and dialogue.

Games

A game is any contest among adversaries operating under rules for an objective (for example, winning or payoff). The adversary may be a computer, the student himself/herself, or another person. Games are versatile instructional strategies that stimulate high-cognitive-level learning.

"Games are versatile instructional strategies that stimulate high-cognitive-level learning."

The discussion explored many of the positive and negative aspects of games as an instructional strategy. Positive attributes included the following aspects:

- Games are a good technique to develop learner involvement and/or collaboration (for students at different sites). They promote good learner control.
- Their effectiveness depends on the target population and individual personalities.

- They can be designed to be collaborative and goal-oriented, rather than adversarial.
- Games are appropriate for computer-based approaches and distance learning because the presence of an instructor is usually not essential. They mediate the absence of resident instructors.
- They can be used in virtually any content area.
- Games are appropriate for autonomous learning environments.
- Games provide closure. Students know when they are done.
- Games can energize any subject.

"Games can turn the dullest subject into one of excitement."

They offer an opportunity for collaborative learning. If instructional games were implemented in distance learning, **unresolved** issues would include the following concerns:

- How can one define competence in the subject matter? Completion alone is probably inadequate.
- Designing good games is difficult, and building good instructional games is even more difficult.
- Not all students are interested in competition, so some students may not be motivated by games.
- A game must be used in the context of the entire curriculum, with its usefulness judged by the results produced. (Using a game as its own end is not defensible in the learning environment.)
- The possibility of students' just trying to beat the game and not trying to learn the subject must be considered in design.

"If time and resources were unlimited, we could simulate anything."

Simulation

In a simulation, a student manipulates a working model of the system being studied. Some simulations present a scenario to which the student responds, others require the student to set up the scenario and observe the results, and others require students to perform in a role-playing manner. Until recently, simulation as an instructional strategy has rarely been used because of cost limitations. Now, with the advent of simulation-based training experiences, it is a feasible strategy (Reigeluth and Schwartz 1989).

The group discussed the range of simulations from simple visualization to role-playing decision making. When using a simulation strategy, an instructor's role changes to that of a facilitator. Discussion on simulation revealed this strategy as a means to an end, not the end itself. Optimal situations for simulations identified were the following:

- Safety is a concern.
- The consequences of inadequate training are costly.
- Specific, tailored feedback is needed.
- Multiple and synchronous activities occur in task performance.
- Time is limited.
- Expanding beyond the instructor's experiences is essential.

The discussion centered around cost and feasibility issues. The consensus was that simulations are excellent instructional tools that stimulate higher-level thinking. However, the cost is a concern. Few low-cost simulations exist.

One concern emerged regarding implementation: Simulations are often designed for instruction but used for testing. Evaluation stifles exploration on the part of the student; learning occurs through exploration.

Coaching

Coaching involves active instructional intervention when the student performs a task or solves a problem. Interaction must take place between the coach and the student. The coach gives individual attention and feedback as needed. Feedback includes evaluation and demonstration of appropriate performance. Feedback may or may not be in real time. Videotaping a learning activity can easily accompany distance learning. It allows one to study that activity so that performance can be analyzed and necessary corrections can be made.

The question of when to intervene is pertinent to coaching both in person and from a distance. However, the answer may be more elusive in distance learning because many of the cues that are available in person will be missing in a distance learning setting, even with very sophisticated audio/video systems. This situation raises the question of coaching strategies in general. Can it be assumed that what works in person will work from a distance? Such may be the case, but clearly some analysis of different coaching strategies will be necessary.

In the typical classroom environment, coaching is not feasible because of the large number of students. The focus of coaching is diagnosis and correction of individual students' misconceptions. In the distance learning environment, coaching is possible through the use of telecommunications and through intelligent tutoring systems.

The discussion of coaching concentrated on describing possible different coaching systems:

- An AI system could learn, log students' performances, and make decisions concerning students' programs at various stages.
- If the coaching option were programmed into a system, the learner could control the level of intervention desired.
- The language laboratory model for coaching is still a useful one.
- Videotaping can be a powerful tool for a coach in live performance training (for example, sales).
- Coaching is equally appropriate for athletic and academic skills.

The group highlighted the difference between coaching and evaluation. Coaching provides correction right after being informed that an answer or action is right or wrong. Evaluation simply indicates than an answer or action is right or wrong.

"In noninstructor coaching, simulation appears to be a necessary requirement."

The subject matter here is more critical than in some of the other strategies. For example, immediate coaching feedback in a speech class would be potentially destructive. Specific coaching examples included computer intervention during a simulation exercise or after a system locks up following an incorrect response during a nuclear reactor simulation.

Dialogue

Dialogue, like coaching, is a strategy that is not feasible in a classroom situation but, with the appropriate technology, can become feasible. It requires a one-on-one teacher-to-student ratio. The only existing models for the computerized dialogue strategy come from the world of intelligent tutoring systems. In dialogue, the **instructor** teaches by guiding the student in conversation to discover new insights into the subject matter. Unlike coaching, dialogue can take place in the absence of task performance or problem solving.

"Dialogue makes distance learning more effective by focusing and funneling the information."

In the small-group discussion, the prevailing opinion was that some learner control must be involved in useful or informative dialogue-based instruction. Student questions to their peers and instructors should be allowed.

Dialogue allows active involvement of the student as well as individualization of the

learning environment. Dialogue also provides feedback to the teacher, which enables him/her to develop a model of the student. To implement dialogue for a group, the strategy needs to include the capability for each student to be involved, which is possible through shifting leadership.

The group reached the following conclusions:

- Dialogue can help negotiate the meaning that the instructor is trying to convey.
- Dialogue manages instruction and allows flexibility and prescriptive, individualized instruction.
- Dialogue helps instruct the teacher and can make a model of the student.

Summary

The instructional strategies topic generated many new ideas for implementing alternative approaches in distance learning. Regardless of subject matter, all four strategies discussed were considered to be useful components of a curriculum.

The computer played a central role in the delivery of each of these strategies in the distance learning environment. The expense of the computer software implementation could range from very low (bulletin board) to high (intelligent tutoring systems). However, low-cost implementation of alternative strategies is now possible. The dearth of models in the literature and software on the market has caused the lack of implementation thus far, but such models are now rapidly emerging.

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Collective Learning

by Andrew E. Andrews

Background

Unlike the other sessions of the conference, the collective learning session concentrated on a subject that was more narrow in scope and more focused on innovations. The intent was to advance the field through the synergistic input of experts.

The expression *collective learning* stems from the military term *collective training*, but each has different goals. *Collective training* prepares a team to work together in a realistic problem situation, whereas *collective learning* develops the knowledge, skills, and/or abilities of an individual through group work. The literature contains several recent studies on *collaborative learning*, primarily in English classes. Collaborative learning can be viewed as a subset of collective learning, with the same goals.

Universally, instruction must provide a high degree of transfer of knowledge and skills to the student, either in the work environment or the education setting. Technology and the information explosion have markedly increased cognitive demands on employees and students alike. While these challenges are complex, the changes further complicate the situation. The requirements of many jobs have changed from **task performance to monitoring complex tasks and impromptu problem solving**. Moreover, our traditional modes of instruction have not proved highly effective to satisfy these requirements.

"By challenging the traditional view of the teacher's authority, collaborative learning helps prepare students for effective interdependence in an increasingly collaborative world."... K. A. Bruffee

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A recent approach, which we will classify as an instructional strategy here, is **collective learning**, the pedagogical approach in which students learn skills individually through a group effort. For example, they may jointly solve a problem, perform a case study, or research a situation and write a report on it.

Dr. Michael Moore of Pennsylvania State University addressed the need for additional focus on the student↔student interaction component of distance learning (Moore 1989). In the past, the focus has been on student↔instructor and student↔subject matter. Unfortunately, the distance learning proponents need more than a mere suggestion to implement such a strategy. They need specific guidelines concerning student↔student interaction (where, how, when, and why). A goal of this session was to develop such guidelines.

Assumptions

- Collective learning requires careful planning by the instructor or instructional designer. It cannot be highly effective as a casual, student-determined strategy.
- Collective learning can stimulate work place communication.
- Collective learning provides some students more effective feedback than is available in traditional settings.

How should collective learning be structured?

Organization. The differences between collective learning and collective problem solving must be addressed. All participants (instructors, students, and course designers) must have a set of prerequisites and a common frame of reference from which to work.

In the training environment today, people are working as individuals, yet most complex problems are group problems. To meet the existing needs, training must adapt to the collective learning group's mode of addressing problems. Therefore, it is important to consider this implied constraint on the organization of collective learning.

A debate persists in the U.S. Army about whether collective learning is **learning** or is **an experience**. No assessment measures exist to settle the issue. For example, the National Training Center (Fort Irwin, CA) has no way to replay a battle and then let units learn to improve their strategies.

Nevertheless, the military uses the field training exercise (FTX) as a collective learning tool. Actually, it is a good example of integrated collective learning and distance learning. Even if there are no predetermined correct methods to evaluate a unit's performance, the FTX usually is a vehicle to build a better unit, a demonstration of effective collective learning.

In **collective learning**, the emphasis is on the learning that an individual must acquire to function in a generic position. There are two types of collective learning. In the first, **specific objectives** are defined, and training is conducted, guided by these goals. In the second, **no concrete goals** exist; learning occurs because of exploration of the subject material and interactions among students.

Synchronous and asynchronous modes of collective learning are different. In **synchronous** collective learning, time limits may be used to put more demands on the students, forcing the students to meet the instructional objectives in a timely manner. Synchronous collective learning is a good approach when pressure on students is needed.

For collective learning, one must consider three evaluation levels: the individual, his manager, and the manager's manager. Questions and performance evaluation must be derived from the perspective of all three levels, helping management's vested interest and providing a healthier collective learning environment.

In collective learning, distinct standards are needed for both the individuals and for the group. The goal is to have the students acquire all the individual skills and to make the transition to a learning mode that primarily meets the group objectives. Often textbook solutions are not available for the group problems, so many different learning approaches may be appropriate. When writing learning objectives, instructors should allow for flexible guidelines. To illustrate this point, they could provide open-ended problems for training exercises.

The structure of collective learning and distance learning must be guided by function or requirements. When the collective learning format is being used to teach individual skills, we use the same measures that traditional teaching uses to evaluate. When team skills are being taught, new evaluation strategies may need to be developed.

Collective learning structure is different from that of traditional learning and varies with the students' diverse backgrounds and the subject matter. Objective performance evaluation measurements must be developed, regardless of the learning objectives or any differences from traditional learning environments.

"When is it collective **learning** *and when is it collective* **problem solving**?"

Troubleshooting is an example of an interesting collective learning environment. For example, the specific goals for learning to troubleshoot a given type of equipment are important. However, accumulating a bag of troubleshooting tricks is also crucial to the transition from the novice to the expert level. Collective learning allows students to find out about other students' "bags of tricks" as they work together.

If the environment is hazardous, it is very important to control the organization of the instruction, and risks and consequences must be considered in instructional design.

The delivery system must be considered when planning training, but it must not drive the total effort. The learning objectives must

be the drivers. One must take advantage of the strengths of technology and use benchmarks to guide the type and amount of feedback.

Techniques for effectively managing multiple dialogues that may occur in collective learning in the distance learning environment must be developed. Dealing with the frustration induced when the network goes down or the local system fails must be addressed to reduce dropouts.

The collective learning designers must also consider the group size. Depending upon the task, a group size of two to eight appears to be optimal.

The composition of the group is an important factor. One must be aware of when it is possible to combine diverse people in a collective learning environment.

The success of a collective learning situation is dependent on the availability of instructors. In addition, the student body may not remain stable. Designing effective learning around changing personnel is indeed challenging.

Because of the time demands on managers in particular, the length of the course is important. Distance learning can allow a one-week collective learning-based course to be spread out over a month, allowing the manager to take care of daily business demands. The time in a learning session should not be too short. Three to four hours seem reasonable for a collective learning management session in the distance learning context.

"The instructor's authority is changed, not reduced."

Instructor Role. The group felt strongly that the role of the instructor will not vanish but must change. The instructor must communicate the course objectives to the students and also must be able to adapt rapidly to changing learning situations and unexpected student responses. He/she must also recognize when students are operating at different levels and intervene to fulfill the learning objectives.

The instructor must judge whether the students' behavior has changed in a positive way. **Has learning really occurred?** This expectation places more demands on the instructor. The instructor's authority will not be reduced; it will be changed by both collective learning and distance learning. The instructor will have to operate at a different level than in a traditional learning setting. Alert instructors can indeed moderate group dynamics and group behavior in a distance learning setting, but it is a challenging situation.

The instructor must be more versatile than in a traditional classroom in terms of presentation of material and real-time reaction to the students' learning modes. The instructor's analysis, group management skills, and subject matter expertise will also be more important in collective learning contexts. Depending on course design, lesson preparation may be more intense and thorough than for a traditional classroom.

An assertive student may pose problems in a collective learning situation, and instructors must handle situations so that such students do not cause the course objectives to be compromised. Although groups can compete against each other, the role of the instructor must be to encourage cooperation rather than competition among the students. In the real world, cooperation gets the job done.

In the military, personal integrity is crucial. Leaders guide units that must follow mission-type orders. The collective learning situation allows integrity to be explored through the way that the group solves problems, and the instructor must carefully evaluate this aspect. The discussion group asserted that in collective learning there is no book solution. The instructor judges the solution and provides feedback to the students.

Student Issues. Collective learning imitates reality. Because of the myriad of potential disasters that can occur in real life, solving problems may greatly improve the secondary skills of students, which may ultimately be more important.

Asynchronous distance learning allows reticent people to have time to contemplate their

answers without being preempted by the assertive students. Furthermore, both asynchronous and synchronous collective learning develop team skills that are useful in other career aspects. These skills may have much greater importance than the short-range skills derived directly from the primary learning objectives. Collective learning increases motivation and may decrease the dropout rate that is characteristic of traditional correspondence courses. More training for a given cost will result.

Loners must be motivated to be team members. Collective learning provides a vehicle to break down the barriers of individuals to be team members. When groups of people work together in collective learning, individuals will be motivated. Furthermore, individuals are challenged to prepare for the learning session to avoid disappointing the group.

Individualized distance learning creates learner loneliness. Collective learning may help ease this loneliness by allowing students to interact. In traditional correspondence courses, students must be very self-disciplined. Collective learning can compensate for a lack of personal discipline. Collective learning can build enduring friendships, which can be renewed through additional collective learning experiences. This opportunity to build such friendships alleviates the loneliness of the learner.

"Distance learning implies the loneliness of the learner. Collective learning reduces the loneliness and motivates students to relate to each other and to the world."

What are the desired characteristics of appropriate tasks that students can perform collectively at a distance?

Small-group discussion identified optimal characteristics of tasks that students can perform collectively at a distance:

- The objective must be clear.
- The problem must be challenging.
- The task must be reasonable in terms of time, skills, and physical resources.
- Specific roles must be assigned.
- A balance between structure and dialogue must be possible.
- Closure must occur to solve a problem cooperatively, to build results together, and to review feedback across the system. (However, how does the instructor know that students have finished? Is closure a separate issue?)

Collective learning works, and there is no difference between tasks in traditional and distance education with respect to desired characteristics.

Two different types of groups are involved in collective learning. For example, in law school, study groups form spontaneously to meet common goals. In other settings, participants may be assigned to projects by a teacher. Evidence indicates that randomized grouping does work.

In addition, a balance between structure and dialogue is necessary to facilitate communication. However, this balance should not become overbearing. Peer pressure alone will act as a motivator to get people working.

The business world is in transition, and cooperative efforts are increasingly important. Therefore, participating in collective projects is advantageous.

Experience has shown that frequently students learn better when they work in groups. Rewarding adult group performance is more valuable than rewarding individual performance.

In what distance learning situation can collective learning be most beneficial and why?

Students. Whenever a group is formed, it will have group characteristics that depend on the individuals and the relationships among individuals. Instructional design must take into account the degree of homogeneity (match or

mismatch in talent, interest, level of effort, motivations, etc.), bonding (strong friendships can be formed and exploited), synergism, and the phenomenon of group dynamics.

"One must design collective learning with the group size in mind."

Studies have shown that students prefer to learn in groups in many situations. There are, of course, exceptions, and any course of instruction needs to allow for those preferences.

The collective level of expertise in the group will determine the requirements for direct interaction by the instructor. In general, the lower the level of existing knowledge, the greater the need for instructor interaction.

Teachers. Teachers may be threatened by the collective learning model because their "dominant role" may be diminished. New training will be required for the changing role of teachers. Perhaps a new concept of the teacher will be as a group manager or facilitator.

Challenges. Currently, many available sources of information are not used. Perhaps the most significant example is the wealth of experience that senior citizens have. If distance learning (in the collective learning mode) could tap into some of those sources, the rewards would be tremendous.

The distance learning environment needs to be carefully considered in collective learning. However, many aspects will be nearly the same as in the traditional classroom. In some cases, the possible asynchronous interaction may be advantageous; that is, decisions or solutions would be considered more clearly before a reply is made.

What are the preferred media for collective learning in distance learning?

This group redefined the problem by noting that media are not the issue. If the appropriate collective learning tasks are identified and the appropriate strategy for a specific requirement is established, then any of the media can be adapted to the task. **Hence, the group focused on appropriate tasks and situations for collective learning.**

What are the reasons for using collective learning? Three valid reasons for using collective learning follow:

- To work at the synthesis level of Bloom's taxonomy, converging to similar ideas,
- To work in a problem solving situation and reach a solution, and
- To encourage group interaction and cooperation.

In addition, the motivational aspects of group work may be sufficient justification for having collective learning experiences. Training objectives determine whether or not collective learning is a desirable strategy, with media selection following accordingly.

Indeed, collective learning is probably not useful at the lower-cognitive training levels (the introductory level, for example). For example, one would not use collective learning to teach someone a basic mechanical skill (how to change an XYZ brake), but collective learning can be used for training on how to fix brake systems in a general way.

Trainers must be confident of the optimal instructional strategy. A professional training specialist from the discussion group said that he has seen three types of collective learning in practice: 1) a professor places a problem on the table and has the group solve it; 2) someone does not want to work with the group, so everyone works on individual pieces and the group synthesizes results; and 3) a hybrid occurs and the individualists work by themselves and others work as a team. Eventually, they fit the pieces together. The real point is **not** to make individualists outcasts but not permit them to hinder the learning process either.

"Collective learning goals are clarification of concepts, problem solving, synthesis, evaluation, and affective domain (interpersonal skills)."

Collective learning content is related to a goal, which is different from traditional distance learning that looks for specific answers from individuals. Using teleconferencing, a class could work together. In this regard, a participant asked whether or not our distance learning conference could have been accomplished by distance learning. Most group members felt that the initial face-to-face contacts were necessary as well as the opportunity to establish a network among distance learning advocates. However, they agreed that using two-way video could have worked for the small-group sessions. Even computer-based training could have been used, where a person is effectively talking to the terminal.

If learning goals demand group dynamics, there is literature that points out how to include the outsiders. The nominal group technique allows for everyone to individually brainstorm a list and then pick one item from each person's list, going around as often as necessary and sharing the collective list.

In multidisciplinary groups, one is challenged to get disparate personalities and backgrounds together and to employ appropriate techniques for the remote learning systems that we are designing. In projects where individuals do not know everything, they can rely on other people to fill in the gaps. However, if the only expert leaves, the group loses part of its collective power.

One must avoid trying to apply collective learning to every situation. For example, in a math game, an individual might solve a problem in 10 minutes, yet a group does it in 20 minutes. However, in survival games, people are put in unpleasant situations and are tasked to compile a list of things one might need. In this case, individuals tend to be less effective than the group consensus. Sometimes an individual on a team will have a valid solution and may be talked out of it. Nevertheless, overall consensus may be better than one person's solution. Instructional designers must consider both short- and long-term outcomes. Perhaps wasting time at the beginning, may bring better long-term results.

If one is looking strictly for answers, then **collective training** might well be the wrong approach. In fact, this collective training idea is contrary to the notion of individualized training. Collective training might be more appropriate for executives than for blue-collar workers because collective learning is quite applicable to upper management where people are trying to develop strategic, marketing, production, and financial plans. In the business world, collective learning might help a team function more efficiently and more effectively.

The application of distance learning technologies does not excuse us from remembering what we already know. We still have to consider multiple strategies, everything we already know, and not expect collective learning to be a panacea. There is a danger of forgetting what we know about the traditional classroom setting. The technology itself is seductive, and learning about it can be so absorbing that we forget our actual goals.

A medium that would let the group draw on many resources to act as a group could be very valuable. Distance learning learners do not always have a library like traditional learners have. A way to integrate resources such as bibliographies, dictionaries, etc., into the rest of the system could be very important. This is also a policy question, not a media problem. If not done properly, we will create the language labs of 30 years ago that were not used. While the requirements of learning should drive the strategy used, implementation of the strategy in a given medium must be done effectively. Further, the media must be both affordable and available.

Most of the discussion addressed pushing the cognitive evaluation of issues rather than the affective domain, yet group learning tends to be more involved with the latter. It is important to develop models for cognitive, physical, and affective domains for particular subject areas.

Summary

Collective learning is a valuable instructional strategy in the distance learning environment. This instructional strategy promotes teamwork, reduces the isolation common in distance learning, provides motivation, enhances pacing of the class, could reduce dropouts, and offers no difference between traditional and distance learning in task characteristics. The bonding that occurs in the interacting community is also important. Such an instructional strategy could also capitalize on the knowledge of the retired population. Distance learning facilitates capturing the collective learning corporate knowledge of individuals, which otherwise would be lost.

It is easier to define where collective learning should **not** be used than where it should be used. Some autonomous learners and anxious people shun collective learning. However, it is a tool that can be used to solve problems that are bigger than a single individual's ability to solve them.

Collective learning goals are clarification of concepts, problem solving, synthesis, evaluation, and interpersonal skills (the affective domain). This strategy is process oriented rather than answer oriented.

The structure of collective learning depends on its objectives, the subject, and the participants and may determine the delivery method, synchronous versus asynchronous.

In a collective learning environment, the instructor's authority is not diminished, just changed, because the situation requires increased evaluative skill rather than presentation expertise. The instructor serves as a catalyst, for providing proper and timely feedback is critical.

Some cautions concerning collective learning included the fact that some students work better computer-to-computer versus face-to-face. Also, the subject matter, the student, and the instructor are all dependent on each other. One concern noted was the possibility of collective learning's impairing individual learning skills. One participant remarked that the applicability and effectiveness of collective learning is dependent on the synchronous interactivity and objectives of the selected media.

References:

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Student Performance Evaluation

by Norman D. Hamer

Background

Determining whether or not a person has mastered a course or deciding if a person can be certified as qualified in the subject matter should be major distance learning issues. In traditional education/training situations, the instructor is usually in a position to directly assess students' abilities in real time. However, large classes and time pressures are forcing the use of less direct testing procedures. In distance learning, the situation is compounded because the capability for direct feedback may not exist. In many accounts about distance learning experiences, one hears about students' passing tests without actually understanding the content and about people who are frustrated by learning the course material and failing the evaluation procedure. Distance learning presents **unique** challenges to evaluating student performance; these challenges do **not** exist in the traditional classroom situation.

"Students have been certified from distance learning courses when, in fact, they have not mastered the material. Students who have mastered the material have been frustrated by the assessment process. The problem is often the testing, not the instruction."

Assumptions

Evaluation of student performance is a critical element in any distance learning system. In some cases, the evaluation system may exist only for self-assessment. However, the trend is for employers to require certification of employees' performance.

A model for proper student performance evaluation in distance learning can and should be constructed. If we are to certify performance, then a standard for performance evaluation must be established. From this standard, a model or models for evaluation in the distance learning setting must be developed.

Construction of Evaluation Systems

Should some specific method or principle be embraced as being the best or most accurate for measuring student performance in the distance learning environment? To adequately answer this question, a number of factors need to be considered:

- types of tests,
- test content,
- administration,
- role of the instructor, and
- interactions.

Test types generally fall into two main classifications: textual and performance. By textual, we mean print on paper and computer-presented questions and answers. Performance refers to simulations, games, interviews (either direct or indirect), and interactive systems, such as holographic imaging interfaced to interactive devices (for example, the "NASA glove"). The system used can have a profound effect on the type of evaluation possible.

The actual **test content** is critical in the distance learning environment. Problems–such as misinterpretation because of the absence of direct intervention, lack of test validity because of cultural and social factors, and cognitive-level mismatch, especially at higher cognitive levels, where

assessment in a distant environment can be difficult–can render the evaluation process virtually meaningless.

In distance learning assessment, **administration** can pose different problems from those experienced in conventional classroom situations. Problems of dealing with cheating, distractions, timing, and misinterpretations can be quite different from those normally encountered.

The **role of the instructor** in testing in the distance learning environment can be quite varied. The instructor may be directly involved in the testing, or he may have no role at all. The level of involvement depends partly on the nature of **interactions** in the testing environment, which can be quite different from those encountered in the classroom. Generally, interactions in distance learning must be anticipated in the course and in the testing.

General Remarks on Scenarios

Different scenarios were presented to each group to stimulate and encourage thinking in new areas. However, some of the scenarios might have been drawn too restrictively, and the discussions did not progress according to expectations because unique challenges were posed. As we enter new areas, we are reluctant to proceed aggressively and inevitably carry the baggage of our own experiences. To initiate new teaching methods in the distance learning environment, we must have the courage to set aside some of our preconceived notions and not worry about deviating from some established systems.

Scenarios and Results

Scenario. Certify whether medical interns who have been taking a satellite course in remote areas of South America can properly perform an appendectomy.

Results. This scenario certainly entails one of the most adverse testing conditions. The difficulty of assessing fine motor skills required for surgery is compounded by the requirement of near perfect performance.

Only under extreme circumstances and with no other alternatives would the group be able to accept certification of the intern in a distance learning environment in the near future because of the life-threatening nature of the situation.

"I would not like a doctor certified by a correspondence course operating on me. If this were a hair dresser or even a diamond cutter, we could certify. But not a surgeon!"

The participants concluded that remote learning techniques are not suitable for some types of skill assessment and that accountability and risk levels were significant factors in establishing the suitability of distant evaluation. The higher the level of risk, the less likely we are to rely on distance learning to certify a person without actually performing the operation.

Certainly distance learning and testing can be used to certify some medical skills. The group noted that knowledge concerning various surgical procedures could be tested by showing video images and querying verbally about what the correct procedure would be. This method could be used to expose interns to situations not generally encountered. However, the group was reluctant to propose a method to assess actual surgical procedures. Furthermore, participants agreed that accountability was a significant factor in establishing the suitability of distant evaluation.

Scenario. The U.S. Army Command and General Staff College has decided to administer the course of instruction developed by the Combined Arms Staff Services School (CAS^3) through distance learning. The course will be administered by the College's School for Corresponding Studies to both Active and Reserve units. Distance learning is the chosen method of presentation because Reservists cannot take a 13-week resident course. For others, distance learning would be just an alternative. All instructional materials have been developed, but a method for certification of student skills must be developed. Evaluation will be

conducted on levels up to synthesis and analysis.

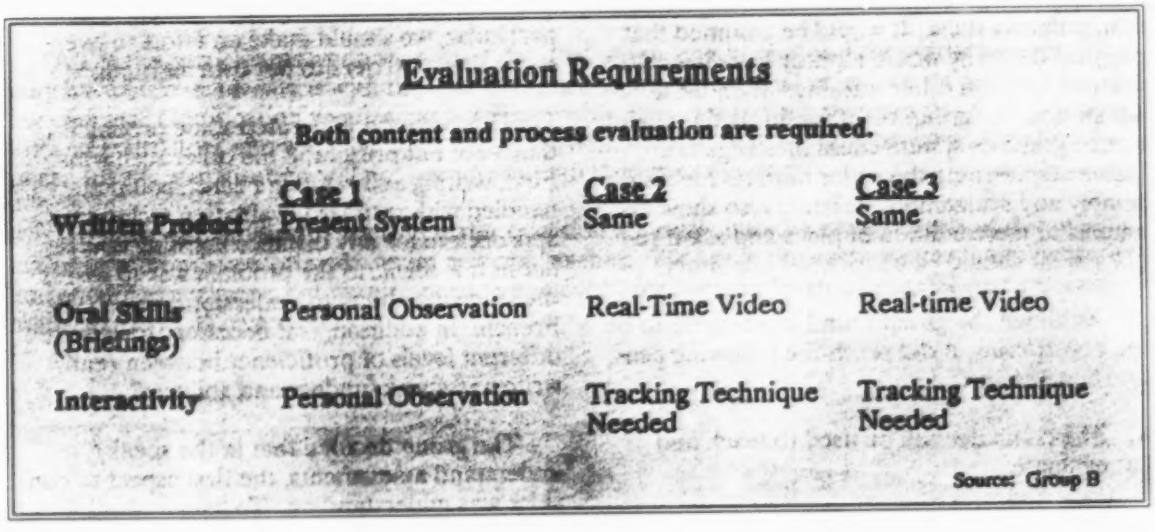
Graduates of the CAS³ course are expected to perform at a minimum standard of excellence when assigned to division staffs in the areas of personnel and administration; intelligence; operations, plans, and training; and logistics and maintenance. When assigned to a division staff position, the officer must work interactively with other staff officers to produce coordinated plans and orders as well as to apply and develop heuristic strategies for decision making.

Results. The CAS³ scenario group felt that it was important to determine how the training was to be done before the evaluation scheme was determined. Three possible organizational setups were proposed.

Case 1 entails an active-duty leader presenting instruction in a traditional classroom. Case 2 assumes that the leader is not present and that the Reserve Components are receiving individual instruction at home. Lastly, Case 3 supposes that the leader/instructor is not present but is responsible for two groups and that the Reserve Components are receiving instruction in an armory.

For these learning environments, delayed feedback and evaluation are reasonable, particularly in situations where Reserve units have to participate in a part-time capacity. For the remote instruction situations, synchronous conferencing in a variety of media could be used to observe or record the student interaction process.

The group decided that the evaluation process could be divided into three areas: writing skills, orals skills, and interactivity. The recommended types of evaluation for the various cases are presented in the following figure.



While the methods of recording performance are plausible with existing technology, the evaluation of such results is always very time consuming and subjective in nature.

Scenario. Test whether dealer mechanics throughout the U.S. know how to repair a new, sophisticated carburetor.

Results. Early in the discussion of this scenario, a participant pointed out that a training and evaluation system for mechanics had been developed recently for Nissan. Someone questioned why mechanics needed distance learning. Why not have all mechanics checked out personally by the head mechanic? However, the group considered that option impractical because of the increasing complexity of cars and because of the large number of mechanics

who must be qualified at a dealership. The standard method of updating mechanics will require some travel to group classes as well as more implementation of distance learning training.

"Testing must be consistent with the training method."

The use of computers for training of mechanics seems extremely sensible as dealerships will already possess computer systems for inventories and accounting. Many dealerships are or will be on networks that could distribute courseware and conduct the student evaluation.

The group agreed that in certain areas more and more certification will be required by local and federal agencies because of environmental and safety issues.

In the actual evaluation, the group assumed that mechanics would not be tested in physical manipulation skills. It would be assumed that physical dexterity would already have been developed through other training. With these assumptions, the group determined that a touch-screen graphics system could interrogate a trainee concerning the order of parts for disassembly and reassembly. It could also show examples of the condition of parts and ask if replacement should be considered necessary.

Although the group found its scenario to be too constricting, it did reach the following general conclusions:

- The computer can be used to teach and evaluate.
- We have unlimited human resources.
- A large number of people could benefit from this type of training within the dealership.
- The number of trainees and their distribution determines the appropriate training method.
- For the future, evaluation and certification will become crucial issues in any training program.

Scenario. Test whether 1,500 second-year university students from throughout the U.S. know French well enough to attend university classes in Paris next year.

Results. At the beginning of this session, group members objected to the presenter's assertion that little literature is available on evaluation. They pointed out that Canada, Australia, and Europe have quite a bit of literature on evaluation.

The U.S. tends to be too introspective, and we should research what has already been accomplished elsewhere in the world. It is difficult to study evaluation in the U.S. because little attention has been paid to the certification issue in distance learning. In addition, it is difficult to ascertain what the rest of the world is doing as few libraries carry many of the non-U.S. journals. In the *distance learning* arena, in particular, we should make an effort to overcome these barriers to our own learning.

This scenario generated some problems that were not present in the other scenarios. First, writing and reading French could be handled with standard evaluation techniques appropriate for any distance learning course, but in this scenario the problem was to assess the students' ability to understand and speak French. In addition, is it necessary to require different levels of proficiency between read/write and speak/understand abilities?

The group decided that in the speak/understand assessments, the first aspect to consider was understanding. To handle this assessment, the students could listen to tape cassettes of a Sorbonne-level lecture, for example, and then write a summary of what they heard. This method would require that the students be placed under classroom-like test conditions. (In a distance learning situation, this arrangement provides opportunities to cheat. Who knows and can verify the identity of the students?) Higher cognitive levels could be tested by having the students analyze and evaluate in French what they had heard on the tapes.

Although tape exchange was considered to be a reasonable evaluation method, many unanswered questions remained. Is there enough time for feedback to be useful? Will there be some scheme for retesting? Shouldn't a pilot test be conducted ahead of time?

"Any quality design for evaluation should have a lot of room for self-assessment."

Grading large quantities of test responses will be difficult. For this scenario, the group decided that the test could be used for the students to do self-screening, that is, to let them check their own answers so that they can determine the level they have attained. They could then determine for themselves if they could study comfortably in France. The group also considered that such an assessment should not be handled by distance learning techniques.

The traditional evaluation techniques may still be the most appropriate methods to handle this type of problem.

Summary

In handling the difficulties presented in the scenarios above, we should not ignore the benefits and challenges of evaluation that exist in a distance learning environment, but not in a traditional learning situation.

In distance learning, we have the opportunity to better control feedback on students' performance. Testing can be accomplished so that students can learn from their mistakes as well as assess the need for further training. Evaluation systems can be self-pacing, flexible, patient, and reusable.

All of the participants were concerned that the people conducting and demanding certification may have little involvement with the establishment of the educational objectives of distance learning courses. Certification requirements will probably filter down from above to the course designers and instructors who will have to incorporate them without destroying good educational practices. Ideally, certification will not become the tail that wags the dog.

We must also be careful not to transfer traditional models into the newer media of distance learning without attempting to devise new approaches. We are in the enthusiastic, fledgling state and should experiment, but we also need to consider how distance learning can become a strong, mature field in its own right.

Implementation

by John Alexander

Background

Consensus indicates that distance learning will play a greater role in future education, while the traditional classroom/schoolhouse approach declines in popularity. Despite this intuitively obvious conclusion, institutions are amazingly resistant to change and normally do so only when pressured by overwhelming external forces. However, on rare occasions, luminaries emerge who have both the foresight and the organizational ability to cause and direct dramatic change before the organization experiences the woes inflicted by those external forces. Ideally, this group can serve as the strategic planners to steer distance learning into mainstream organizations of the future.

We resist change for many reasons:

- financial cost,
- lack of technology,
- lack of skills (delivery/student/instructor),
- lack of understanding of a new approach, and
- vested interest in the current approach (comfort zone/inertia).

What is needed is a plan that not only overcomes these obstacles but is also so attractive to potential educators and their administrative decision makers that they will accept the concepts.

With finesse, this acceptance will be accomplished so that it convinces the educators that they originated the ideas. The challenge is to gain acceptance of distance learning and acknowledgment of the major contribution it can make to society.

Organizational change requires three entities: an identifiable product to which people can relate, proof of accomplishment, and, finally, organizational executive support.

Because we know where we are at this point, we must create the desired objective state and then design a plan to that state from the present. This plan should include the following:

- strategies to gain acceptance,
- demonstrations of significant advantages,
- technology requirements,
- methodologies to educate users (educators and students),
- instructional techniques,
- curriculum development techniques/requirements,
- evaluation methodologies,
- determination of decision makers to be influenced,

- identification of resources required (people, funding, knowledge, things, time), and
- identification of the responsible action agency.

Implementation questions to be answered by the conferees included the following:

- How should distance learning be implemented in future educational/organization settings?
- What do we as a nation need to do to exploit distance learning capabilities?

To prevent this task from becoming overwhelming in the time allotted, we divided the effort among four groups. We asked each group to produce at least an outline that would provide the guidelines for addressing the problem statement. The goal was to develop a generic strategy that, with appropriate modification, could be tailored to successfully cause the smooth introduction and acceptance of distance learning. In addition, a fifth group, representing a cross section of distance learning advocates, was created to discuss immediate implementation.

What methodologies should be used to inform/educate those involved in distance learning, including students, educators, administrators, and technicians?

Results

- Define administrators as implementors and technicians as product/delivery support.
- Use distance learning techniques to inform/educate.
- Target information to the audience.
- Point out benefits from implementation.
- Point out consequences if not implemented.
- Emphasize short-term advantages.
- Emphasize the opportunity to employ high technology, a useful tactic at the policy maker/administrator/educator level.
- Add executive/policy maker as fifth category to the list of people requiring information or education.
- Emphasize specific problem(s).
- Design a generic distance learning strategy.

In addition to the major points, the following commentary was made about the question provided. The group decided to provide definitions for the terms *administrator, manager*, and *technician*. An **administrator** was seen as one who implements policy provided by an external group. For example, local schools follow state guidelines. **Managers** function much like administrators but have resources to allocate. **Technicians** deliver support functions, such as camera operators.

Technicians are important as they advise on the level of technological support available. On the other hand, because of the general lack of creativity, we have "talking heads" on video screens.

Cost must be refined when talking to policy makers. A person must be able to address all kinds of costs involved–direct costs, sunk costs, direct savings, indirect savings, and cost avoidance. Cost is not only measured in dollars but also in time, equipment, and other assets.

To influence each category, we must be able to answer the question: What is in this for me (the person in that position), or what is the drawback of not doing it (distance learning)? To answer these questions, the following chart was generated.

Implementation Rewards/Nonimplementation Drawbacks

Target Audience	Implementation Rewards	Potential Risks of Nonimplementation
Executives/Policy Makers	Increased productivity Increased customer satisfaction Higher profit margins Better trained workers Lower turnover	Falling behind competitors Loss of money/capability
Administrators/ Implementors	Fewer resources required or more accomplished with existing resources Promotions by high-visibility project Added flexibility	Failure to meet stated objectives Administrative consolidation
Teachers/Presenters	Recognition, credibility, and visibility Increased expectancy level Shift onus of learning to student Solution for discipline problems Team teaching Use of content specialists Global access to other teachers Improved teacher/student interactions Improved resource selection/integration Better selection and integration of materials and teaching resources Better teacher/student interaction Experts available via satellite	Increased work load Loss of certification
Students	Increased learning opportunities/ convenience. . . when, where, and how to learn subject matter Access to otherwise unavailable courseware Availability of more student-student interactions New, vibrant presentations Increased subject matter depth available	Subjects unavailable Limited depth of subject matter Unmet graduation requirements More time in classroom required Inability to "go to" college Lack of job opportunities Lack of opportunity to excel, especially in the military
Community	Enhanced self-image and outside image of community Better training of community service providers (police, fire, etc.) Labor force retraining capability Better informed citizenry Improved ability to attract industry Ability to maintain cultural ties Support for civic clubs, churches, etc. Greatly enhanced adult education opportunities	Loss of autonomy School consolidation Decreased tax base
Technicians (Production/ Delivery Support)	Incorporation into creative process Potential for skill enhancement Creativity outlet Barriers broken down with educators Increased job status/salaries Enhanced status Increased/improved hardware	Lack of work Limitations of constant/ decreasing budget situation

Source: Small Discussion Group A

The group noted that specific objectives must be defined and that the proposal must show concrete problem solving. General comments about benefits will not be sufficient to gain a favorable decision that requires resource allocation.

Examples of applications in which effective use has achieved positive results were suggested. Examples include higher sales and profits, competitive advantages, better trained workers, lower turnover, or improved safety records. Public schools are very sensitive to the quality of their product. Small school districts generally cannot compete for top teachers. Distance learning may provide the only viable option for them to have high-level instruction in technical areas.

Administrators. They should implement and manage distance learning. They may demonstrate that they can perform their job responsibilities more effectively for the same funding currently available. This approach provides an additional dimension in flexibility.

They can be attracted to personal recognition for having done a good job and for keeping abreast with advances in their field. Some administrators want hands-on products they can try out, which should be done in such a way that minimizes the risk of embarrassing them. Make it fun.

Schools generally try to avoid consolidation. Distance learning provides an opportunity to share resources and remain autonomous. Furthermore, satellite links are relatively inexpensive.

Educators. They may be influenced by recognition, visibility, and credibility in their field by collaborating with broadcasts. This approach provides a better selection of course material and expert resources to draw on and allows the teachers to integrate the distance learning lessons into their own courses.

Teachers must be trained in distance learning techniques so that they understand the capabilities of the system, and teachers should be involved in the management of the program.

Distance learning could be linked to merit pay. Some feel that acceptance will come only if associated with pay.

Students. Distance learning meets the time requirements of adult students and may be more convenient in method of delivery. They will be able to see top-quality delivery and explore topics at the desired depth. Distance learning provides for a potentially higher degree of student control regarding pace, choice of materials, order, and access to help.

Distance learning provides for interactivity among students. The business world likes networking concepts and has benefited by allowing and encouraging the exchange of ideas through interactivity. Distance learning also provides a multimedia curriculum, which could meet students' varying learning styles and could reduce the actual delivery time, allowing flexibility and maximum use of learning time.

Technicians. They should be renamed as operational support and not be teachers, but they may be highly educated individuals who are required to keep up with the state-of-the-art in technology. The whole system will fail without them.

In the military, there is a significant challenge to get educators and technicians to work together; using technicians to help implement distance learning would remove the perceived low social status of being a technician.

General Issues

Community support is necessary because it frequently provides the needed physical facilities. Distance learning can be used to support civic organizations and more traditional education institutions. Public television provides an opportunity to offer distance learning courses.

The public image of a community is important, and having better-educated people will attract industry. More employment in higher paying jobs will raise the tax base of that community.

In addition, multicultural communities can maintain ethnic ties.

Significance

- We recognized that if one wants to sell distance learning, a person should use the same tools used to sell anything else.
- We can use distance learning to sell distance learning and products, such as a particular educational television channel.
- We must target presentations to the audience.

What do decision makers need to be positively influenced, and how should such an action be accomplished?

Results

- Decision makers are dispersed (military, public education, business).
- Distance learning needs top-level (CEO) support but also needs concurrence from many sources.
- We need a strategy to influence top-level executives.
  - Other users (Who has done it before?)
  - Low down-side risk (off the shelf and field proven)
  - Bottom line (cost-effective financial climate)
  - Use heavy lobbying effort for political appointees and tie their names to positive results.

In large organizations, such as the military, public education, or big business, decision making is far more diffuse than generally realized. Even though an organization has a commander or CEO, it rarely makes decisions without the support, advice, or consent of many others.

". . . a rush to be second."

Those who provide input are not homogeneous bodies and frequently have agendas and interests that vary greatly from those of the top decision maker. To influence these people, one must know and understand the differing viewpoints of each group and be able to tailor, in a consistent fashion, arguments that will gain their support.

With many CEOs, there is a "rush to be second," which implies that they wish to be seen as forward thinking and that they accomplish business by quickly adopting new, innovative ideas. This approach is a risk reduction technique, which if well executed, allows large organizations to appear to be leaders. To influence this group, one must be able to tell them who has successfully employed the technique or program being advocated.

Low down-side risk means that managers like programs that provide only small losses in the event of failure. Such low down-side risk is managed by using only existing technology, which can be bought "off the shelf" without research and development. Furthermore, they prefer field-tested and proven approaches.

With the military, and some companies, a leadership turnover problem exists. People do not remain in place long enough to formulate and implement programs.

"My main problem is mean time between mind changes." . . . Col. Lunsford, U.S. Army Project Manager, Training Devices

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Influencing groups who experience high turnover rates to use distance learning means continuous updating and backtracking. One must follow the changes in organizations and be prepared to meet with and convince new key players, which can be difficult if the personnel action was designed to generate a change in direction, such as with a new political party coming into office.

Agreement going up the chain of command is important for program initiation. Once established, agreement coming down is important for successful implementation of the program.

We need to have a champion who will "carry the ball" and see that actions are executed. This person may, at times, have to subordinate his/her wishes and give credit to a more senior official who desires to be perceived as the concept leader. Frequently, both positions will be required to reach the goal.

For projects requiring political support, we must allow politicians to be identified as the proponents of successful projects. Intense lobbying is sometimes required to gain their support.

User support is important and includes both students and parents in the schools. In industry, it includes workers and supervisors.

Industry will respond to cost savings. Demonstration projects are a good and safe way to obtain further support. Training as protection for investment also makes a strong case. Training budgets are tied to production priorities, and high-priority projects that directly impact production are more likely to be funded than maintenance functions.

An approach that would join industry and local schools would be to have consortia adopt groups of schools in support of distance learning. Having consortia involvement can prevent turf battles that emerge if single companies establish relationships with specific schools. In addition, people are concerned that telecommunications companies may exploit the field for future profit.

Issue:
Do we need a national strategy? YES!

Caution: Some feel this idea "flies in the face" of 200 years of tradition of independence of local school systems.

However, issues, such as interstate certification of instructors and instruction, would be handled more easily with a national approach. We must establish standards at the national level.

Technology now permits far greater distribution of training than has been possible previously. We must capitalize on the advantages provided by this opportunity. A group member suggested that the policy and funding should come from the federal level, but the execution and administration of the programs should be conducted at the state level. However, such an approach would require a great deal of attention to details.

At present, not a single organization supports distance learning and can act as a lobbying force at the national level. Nevertheless, momentum exists at the national level and is evidenced by the Office of Technology Assessment's (OTA) study on distance learning requested by four senior senators. Additionally, President Bush has acknowledged distance learning publicly on several occasions.

Two organizational approaches were suggested. There was general, but not total, agreement that a national distance learning initiative should be conducted from within the government. The second approach suggested a nongovernmental body with close ties to the government.

In the governmental approach, the Department of Education would establish a deputy director position for distance learning.

Recommendations

- Apply both top-down and bottom-up initiatives. Neither will succeed alone.
- Get distance learning on the agenda for the next National Association of Governors meeting.
- Call your governors and get them interested in distance learning.
- Establish a coordinated lobbying effort.
- Promote business consortia in support of groups of schools.

Significance

- Decision makers want
  - consensus,
  - the bottom line, and
  - risk management.
- A national strategy is necessary for growth.
- We need to work from the top down (lobby Congress, Department of Education, and governors).
- We also need to work from the bottom up (inform school boards and administrators and substantiate with demonstrations).

What resources are required to implement a national distance learning strategy?

Results

The group suggested the following ideas:

1. Increase the price of gasoline. *We can pay for distance learning if we want it!*

2. Remove institutional barriers (for example, "ownership").

3. Allow alternate career paths (credit for course development and teaching as well as for research).

4. Help top people become comfortable with computers.

5. Work on para-educational systems.

6. Work with high-status groups.

7. Encourage cooperation, collaboration, and competition.

8. Cultivate champions (friends in high places).

9. Be certain that research has demonstrable results (rigorously provable).

Comments on Policies

- They may be established by industry's need for distance learning before educators or government does anything. (Will industry cause/generate a national policy?)

- Employers may pressure universities into giving distance learning courses.

- State and local authorities may have a significant effect on what is allowed to "flow in."

- They may develop from the ground up (showing worth of smaller projects that are linked into larger projects), which may be more effective in introducing distance learning than the top-down approach.

Resources

Instructional materials already exist in a number of areas. A group member said that the University of the World was cited as an example where database development is occurring.

As far as equipment and facilities are concerned, TVs, computers, and telephone lines are in place in today's schools.

Policy as a Resource

Policy can be a resource because it is something that must be created and developed. One must realize that any national policy can be a double-edged sword, as one may not like the policy or rigidity imposed on the system. To have a policy, goals need to be quantified. In developing goals and policy, it should be understood that in the history of the U.S., education policies have been made at the local level. Educational administrators will be reluctant to change the basic system they have in place.

It may be best if national policy stays away from planning course content and detailed teaching methods. National policy should be directed more toward the base construction, such as getting funding for equipment and making money available for the training of the people who are to develop the distance learning courses. National policy should also be directed to developing a center for storing, disseminating, and coordinating information dealing with distance learning.

If a distance learning system is to be developed nationwide, the question is how, when, and where to install it. Possible locations to consider are homes or schools, National Guard armories, and local libraries. However, this solution would be detrimental to those already disadvantaged by the technological revolution. A large number of microcomputers are already in place in the public school system. Although these microcomputers are not state-of-the-art, to start a national system would be reasonably straightforward at this lower technology level. It would also provide equality of opportunity.

From where will the leadership for implementing this resource come? If economics drives it, then the corporate bodies may be the initiators of distance learning policy, as they already have a great commitment in this area. On the other hand, school administrators, as

we have already mentioned, will probably resist changes in policy that upset the status quo. In addition, at one university, departments were discouraged from producing courseware because of disputes over ownership and over the dilemma of who would reap the rewards from the creation of the course. For these reasons alone, it is very likely that real distance learning advancements will come from outside established school and university systems. However, the effects outside of schools and the community, in general, will probably impact our entire society.

Actually, general distance learning systems are already in place in many foreign countries. Maybe the U.S. should ascertain what can be learned from experiences in those countries.

Significance

No matter how quickly we develop policy, generate funding, or produce the hardware, finding people capable of developing effective distance learning will be the main problem for the near future. Why are the universities not gearing up to produce the people that are needed?

". . . no point in trying a rational approach to prove the value of distance learning over traditional methods–as no one has been able to prove rationally the value of traditional methods, and they have survived."

What needs to be done to insure that the technologies required to implement distance learning will be available when needed?

Results

The group identified the following needs:

- Learning must be taken out of the schools and made into a community issue for everybody. Kindergarten through 12th grade is not enough. We must redefine the role of the school as the center of community learning.
- Perceptions of the distance learning graduates must change.
  - Acceptance
  - Credibility
- We need better paradigms on the impact of human replacement.

The group proposed the following solutions:

1. Change the national paradigm:
education = lifelong community learning

2. Use instructional technology + theory to support distance learning.

3. Create the pull on technology with items #1 and #2 above.

4. Identify the risks to society for not making changes indicated above in items #1 and #2.

5. Work from the top down and the bottom up.

6. Build an outstanding technology-based curriculum and make it available to everyone.

"However, how does one sustain the push?"

Although the group was asked to address the question of how to make the appropriate technology available when needed, it actually discussed the ways to implement distance learning as a whole. It would be to our advantage if we knew what is inhibiting the implementation of distance learning today. Perhaps it is not technology that is holding us back. In addition, what are the research and development needs–both strategic and tactical?

One problem is the perception that distance learners are not as well educated as traditional students. The real point should be **what you can do, <u>not</u> what school you attended**. The true issue here is one of differing standards. If the educational system had a national standard, then there would be no question of credibility.

"If an outside force had imposed our present educational system upon us, we would go to war."

We do have significant problems with our educational system, and we need new educational paradigms where technology is used to

enhance rather than replace human performance. This strategy should not overhaul the present educational system; instead, it will be an educational revolution. This type of change will have to be based on policy and the society. We need to take education out of the schools and into the community. Quality education needs to be available for all ages and locations, like health care is today. The new paradigm would require education to become lifelong learning, based in the community. Ultimately, it should be embarrassing to admit that one is not involved in education.

First, we must convince the public that a problem exists. It is difficult to detect the consequences of poor education. To identify the risks, we have to establish the consequences of NOT making these types of changes.

This strategy needs to be implemented by a tactical plan. Included in such a plan would be a huge public relations effort on the scale of the present media war on drugs. A Capraesque movie showing a future without these changes, along the calibre of "Dead Poet's Society" or with the type of message found in "Bright Lights, Big City," could be part of that effort.

Technology will not be the thrust behind the changes. With better instructional technology and theory for distance learning along with this educational revolution, technology will be pulled along. The group agreed that having the needed technology at the appropriate time will not be a concern.

What must we avoid if we want to see distance learning "take off?"

Major Points

- We need a Strategic Education Initiative–not an emergency, but a crisis.
- The leadership should be assumed by a national lab-type organization.
- We already have the resources, but they need to be organized properly, which does not require that much money. We need efficiency in funding research.
- We do not need a center OF excellence, but a center FOR excellence that combines the work of all the fine people in this field.
- We need some type of infrastructure first, technology second (that will draw the technology into society).

Commentary

The group felt strongly that we need a calling: a "sense of going to the moon." This feeling could capture the imagination of the American public and focus appropriate resources. In that respect, Michael Moore of Pennsylvania State University suggested that we need a Strategic Education Initiative (SEI).

The SEI concept was very favorably received. However, consensus was not reached on how to implement such a scheme. Debate ensued about whether the initiative should be a government program versus one organized by the private sector. Arguments in favor of the private approach implied a lack of confidence in the capability or willingness of the federal government to organize and conduct such an innovative project.

Participants noted that NASA and SDI have been successfully launched within the governmental structure and against stiff opposition. There was consensus that successful implementation of an SEI would require both a top-down and a bottom-up approach, and no single organization could accomplish the task alone. They mandated a united effort.

"Distance learning is part of the solution to the education crisis, but it is not the whole solution. We are part of that solution."

Lifelong learning is everybody's business. We must develop new communities of scholars. Currently, education is drifting away from being everyone's business to being concentrated in the schools–letting everyone "off the hook," which is unacceptable. Nevertheless, we persist in perceiving education in terms of the traditional schoolhouse. Perhaps there is another viewpoint. Perhaps another perspective is the solution–more than just the schools.

Trying to put distance learning in the format of existing institutions, indeed, is probably flawed. The natural tendency is to erect barriers because the instructor is threatened or because the institution is threatened. If distance learning is properly presented, both could benefit.

Furthermore, a national distance learning concept may also be flawed because of having to respect states' rights and other territorial boundaries. Trying to put distance learning into existing institutions using traditional formats is also probably flawed. To sell the concept of distance learning, we must sell the idea of re-conceptualizing our educational institutions–the schoolhouse and the traditional classroom. How we think of learning institutions must change, which will not be easy because most people have grown up thinking of schools in a specific way. Underlying the discussion was the tenet that we do not want to repeat mistakes that have already been made in the field of education.

"Distance learning can improve the quality of education as well as provide an opportunity for expansion."

Using the open university concept, as opposed to traditional methods, has reaped good results. We could sell distance learning **using** distance learning. However, care must be taken to accommodate the cognitive level to the audience.

The National Technology University is a direct result of industry's meeting a need. Each institute maintains its own courses but works toward a common goal because several industries financed it. If we could develop the trunk line that would facilitate better data communication, we would be in a more favorable position. Perhaps when the cost of education becomes excessive or the quality of education becomes too inferior, parents may regard distance learning as a solution to the dilemma.

Distance learning can improve the quality of education as well as provide an opportunity for expansion, yet institutions do not want to die. Can we risk stating that distance learning prevents the demise of an institution? "How many blacksmiths opened gas stations at the turn of the century?"

"How many blacksmiths opened gas stations at the turn of the century?"

Distance learning is part of the solution to the education crisis, but it is not the whole solution. **We** are part of that solution.

Strategic Education Initiative (SEI)

We need an SEI. We are not in an emergency, but a crisis. The situation could be improved. Many positive projects are presently underway. Currently, distance learning proponents are decentralized and diffused. We do not need a center OF excellence (**to exhibit it**), but an SEI, a center FOR excellence (**to promote it**) that incorporates existing organizations/agencies and integrates, coordinates, and focuses the work of all the fine people in this field as well as disseminates information and projects an image. We need some type of infrastructure first and technology second, meaning a way of integrating the technology into society. We should not exclude the existing schools nor invent a totally new institution, but we should use the potential of distance learning as a parallel support opportunity.

"We need a Strategic Education Initiative. . . not an emergency, but a crisis."

With a national effort, we could achieve a national telecommunications-based system in 5 years instead of in 25 years. People tasked with the job of restructuring education with distance learning could do so with strong national political support and the promise of financial assistance. **Actually, we do not need more money devoted to solving the education crisis.** However, we do need a reapportionment of existing funding to capitalize on solutions with greater potential.

In fact, we can probably save money. Even if SEI were funded at $10M a year, that amount would merely be a drop in the bucket. However, if we have to spend significant time justifying such amounts, we would not progress.

We need more efficiency in funding research. Ten million dollars would not "buy" many people, but it could finance an outstanding center for excellence.

Not reaching 9,000,000 kids is a national emergency. We lose half of all kindergarten through 12th grade students by their dropping out. Packing these students' brains with information should not be the goal of learning at this level, but we should strive to teach them how to learn. We need to look beyond technology and redesign the role of the teacher. We can restructure the role of the teacher by changing the curriculum of teacher training. We need to re-examine our expectations of the education system.

We also need to re-conceptualize what education is. Our expectation of education has to change. If people (including the teacher) can discover things mutually, the learning environment may change. Learning will become exciting!

Leadership

Distance learning needs a high-level champion. We need a national leader who will propose that we need such an SEI effort. This leader should be supported by grassroots efforts across the country. We have to handle the situation differently to capture the attention of a politician. We must contact state senators and representatives and offer these particular suggestions. We need to write letters to motivate them to become involved as distance learning advocates. Such a distance learning initiative can certainly be appropriate in the changing perspective and image of the national laboratories.

However, one expert questioned if LANL would be so technology driven that it would have difficulty acting as distance learning's national leader. In response, an administrator from the Laboratory said that he did not believe that the Laboratory is technology driven and that distance learning deals with a wide range of technologies. Shortages in those technologies hold the secret to bringing distance learning to fruition and sharing those answers with a broader class of people, which falls in the realm of technology transfer and would justify the Laboratory's role.

Center

We are recommending the establishment of a center so that we can collaboratively seek funding and produce research. A mixture of academia, industry, government, and the military is valuable and should be exploited for the advancement of distance learning. There must be many examples of cooperation between educational institutions and the military already in existence. How do we find them and then how do we become less invisible to them?

Its advocates should not be working in isolation. Our country already has the resources; they need to be organized properly, which does not require extraordinary sums of money. We need efficiency in funding research. We also need to be centralized in our effort, not diffused. On the other hand, one member of the group felt that the center should not be a place but a group of decentralized people.

Resources

We have content resources and incredible communication resources, unrivaled anywhere else in the world. What we do not have is a body of scholarly work, a codified distance learning knowledge base, such as a distance learning textbook. There is more research than we have been able to assemble. We need to establish data on how this body of knowledge actually works before we can establish ourselves. We have the resources; we need a national effort to consolidate these elements.

Satellite technology makes it easy to cross over state lines. What we need is a "pipeline" that is analogous to a computer network that would facilitate distance learning communication. Participants suggested that Los Alamos National Laboratory could set up such a network. Such a center would facilitate communications among diverse groups, including the military and academia.

Summary

What we need is a STRATEGIC EDUCATION INITIATIVE.

This feeling of urgency was at the heart of the group sentiment. In other words, we need a rebirth, a vision, a sense of going to the moon. Participants recognized a crisis in education, which is not a new or unique thought, but one reinforced by the combined experiences of this multifaceted group comprised of education, industry, military, and government representatives.

Although there is a perceived crisis, it is not considered an emergency. In spite of many negative interacting factors, this situation could be improved, and many positive projects are already underway. What is required is a concerted effort to bring the resources of the nation to bear on this problem in a coordinated and focused way. There is a call to arms: the need for a display of national-level leadership supported by grassroots efforts across the country.

The top leadership of the country, the president and key members of Congress, are already vocally supportive. Now is the time to press forward with initiatives and establish a ground swell that can capitalize on that hard-earned advantage.

Distance learning is not a panacea. Future efforts must be coordinated with traditional school systems that will continue to be the cornerstone of our basic education in America. The mission is to enhance, not compete, with existing institutions. Complementary roles will reduce the fear of change while providing for the needs of all sectors of our communities.

Epilogue

Participants left the conference with an overwhelming impression of urgency and commitment to market the distance learning concept beyond specific institutions and provincial interests. We have a technology to sell and should not be working in isolation! We must convince the bureaucracy at the state and national levels that distance learning works. Furthermore, we must focus on a broader implementation of distance learning in the home, for asynchronous presentations, and for integration of technologies into the field.

American education is in a crisis. We cannot afford enough teachers to ensure that every learner can fulfill his/her potential, much less have a tutor or classic apprenticeship relationship. Even to maintain the status quo, the need for knowledge, skill, and ability acquisition will continue to grow. **Distance learning provides a solution.** At the conference, people examined particular technologies as solutions to these problems and acknowledged that distributed training systems are capable of integrating technology.

Distance learning offers a low political risk with a high political payoff as well as moderate to high technical risks and potentially high technical payoffs for the nation.

In conclusion, the conference assembled people of varying backgrounds and interests, expanded horizons, gave direction to distance learning advocates, created a valuable network among participants, and inspired further cooperation to advance this exciting field.

Distance learning is a significant component for solving the American education crisis. All communities must work together to implement this solution, prove that distance learning is justifiable, and work enthusiastically to demonstrate the value of lifelong learning.

Author/Presenter Biographies

John B. Alexander is the manager of Anti-Materiel Technology (soft kill) in the Defense Initiative Office at Los Alamos. This position entails creating new weapons concepts that degrade or destroy threat systems by attacking materiel rather than personnel. He holds a B.A. in sociology from the University of Nebraska-Omaha, an M.A. in education from Pepperdine, and a Ph.D. in education from Walden University. He retired as a colonel from the U.S. Army in 1988. While in the military, he held various research and development positions, including director of the Advanced Systems Concepts, Laboratory Command, and manager of the Technology Integration Office, Army Materiel Command. Previously, he served as chief of Advanced Human Technology, Intelligence and Security Command, and advised the intelligence community and later the National Research Council on enhancing human performance. As an officer in Children's Hospice International, he is deeply involved in the issues of dying children and their families.

Andrews E. Andrews is the group leader of the Cognitive Systems Engineering Group at Los Alamos National Laboratory. This group designs and develops experimental simulation-based training. He holds an M.S. in engineering from the University of California at Berkeley, an M.B.A. from Long Island University, and a Master of Military Arts and Sciences. Before working at Los Alamos, he held varied positions in the U.S. Army that included responsibilities for exercise and training development. He culminated his Army career as the senior air defense staff officer at the Supreme Headquarters Allied Powers Europe. Andrews has published many papers, principally regarding military doctrine and computer-based training.

Norman D. Hamer obtained a B.S. degree in chemistry from Arizona State University, where he also participated as a proctor when Professor Fred Keller first introduced his plan of self-paced instruction. After receiving a Ph.D. in theoretical chemical physics at Massachusetts Institute of Technology, he served as a guest researcher at the Kamerlingh-Onnes Laboratory in Lieden, Holland. He then taught and did research in the Physics Department at the University of Toronto. Before coming to the Cognitive Engineering Systems Group at Los Alamos National Laboratory, he served for 15 years as a faculty member in the Chemistry Department at the Australia Defense Force Academy and the Royal Military College in Canberra, Australia.

John W. Keller is a graduate research associate in the Cognitive Systems Engineering Group at Los Alamos National Laboratory. He holds a B.A. in cognitive science from the University of California at San Diego. He recently attended a distance learning course that was offered by the University of Wisconsin at Madison.

Mary S. Trainor holds a Ph.D. in science and mathematics education and is currently deputy group leader of the Cognitive Systems Engineering Group, Los Alamos National Laboratory. She has been an instructional psychologist in CBT projects for 14 years. She is currently the president-elect for the Association for the Development of Computer-Based Instructional Systems (ADCIS).

List of Participants, Distance Learning Conference

Dr. John B. Alexander
Los Alamos National Laboratory
DRA-DIO, MS F613
Los Alamos, NM 87545
(505) 665-3586

Mr. Marshall E. Allen
Educational Television
Oklahoma State University
Telecommunications Center
Stillwater, OK 74078
(405) 744-5960

Mr. Andrew E. Andrews
Los Alamos National Laboratory
A-6, MS M997
Los Alamos, NM 87545
(505) 665-0732

Dr. Stephen F. Brown
1339 Oak Path
San Antonio, TX 78258
(512) 497-8201
Compuserve 76327,2462

Mr. John E. Buckley
HQ TRADOC, Attn: ATTG/CF
DCS for Training TDAD
Ft. Monroe, VA 23651
(804) 727-4265

LTC James S. Cary
HQ DA, Attn: CSDS-FM
The Pentagon, Rm. 3D614
Washington, D.C. 20310-0200
(202) 695-8029
Army FORUM/Army PROFS-caryj
Bitnet via university of michigan
FAX: (202) 695-4399

Dr. Vincent P. Cieri
119 Queens Drive South
Little Silver, NJ 07739
(201) 747-3183

John deVries
Los Alamos National Laboratory
A-6, MS M997
Los Alamos, NM 87545
(505) 665-0514
jad@lanl.gov

Mr. Thomas E. Downey
Boeing Aerospace
P. O. Box 3999, MS 3F-22
Seattle, WA 98124-2499
(206) 657-1050
Bitnet 7742344@UWACDC
Compuserve 71460,3171
FAX: (206) 773-0008
ADCIS on PEACENET

Mr. Thomas J. Edwards
Hq. U.S. Army TRADOC
Asst. DCS/Training Plans
Fort Monroe, VA 23651-5000
(804) 727-3141

Dr. Richard E. Farson
Western Behavioral Science Inst.
P. O. Box 2029
La Jolla, CA 92038
(619) 459-3811
FAX: (619) 454-7612

Dr. Linda D. Fenty
Electronic Data Systems
7450 Boston Blvd.
Springfield, VA 22153-3197
(703) 644-8150
FAX: (703) 644-8250

Professor Barbara M. Florini
Assoc. Prof. of Adult Education
Syracuse University
Kellogg Project
113 Euclid Ave.
Syracuse, NY 13244-4160
(315) 443-1095
bflorini@suvm
FAX: (315) 443-1842

Mr. John F. Fox
Los Alamos National Laboratory
HRD-3, MS M589
Los Alamos, NM 87545
(505) 667-5247
jff@lanl.gov

Professor Terry L. Gibson
Assoc. Prof., Univ. of Wisconsin
605 Extension Bldg. 432
North Lake Street
Madison, WI 53706
(608) 262-4877

Professor Jack D. Gittinger
Assistant Professor, Dept. of TOE
University of New Mexico
Albuquerque, NM 87131
(505) 277-6640
jack@unmb (BITNET)

Prof. Charlotte N. Gunawardena
Assistant Professor, Dept. of TOE
University of New Mexico
Albuquerque, NM 87131
(505) 277-5046
lani@unmb (BITNET)
lani@bootes.unm.edu (Internet)

Dr. Heidi A. Hahn
Idaho Nat'l Eng. Laboratory
Now with
Los Alamos National Laboratory
A-6, MS M997
Los Alamos, NM 87545
(505) 665-4606

Dr. Stanley M. Halpin
U.S. Army Research Institute
P. O. Box 3407
Ft. Leavenworth, KS 66027-3407
(913)684-4933
halpin@alexandria-emh2.army.mil

Dr. Norman D. Hamer
Los Alamos National Laboratory
A-6, MS M997
Los Alamos, NM 87545
(505) 665-0722

Dr. Stephen W. Hartman
Assoc. Prof.
American Open University
New York Institute of Technology
211 Carlton Ave.
Central Islip, NY 11722
1-800-222-6948

Dr. Ronald C. Hofer
US PM TRADE
12350 Research Parkway
Orlando, FL 32826-3276
(407) 380-8077
hofer@orlando.enchl.army.mil

John W. Keller
Los Alamos National Laboratory
A-6, MS M997
Los Alamos, NM 87545
(505) 665-4231
jwk@lanl.gov

Ms. Susan M. Leslie
IBM Corporation/Fourth Floor
2321 Whitney Ave.
Hamden, CT 06518
(203) 287-7079
ADCISTX on PEACENET

Mr. David R. Littlefield
Los Alamos National Laboratory
A-DO, MS F606
Los Alamos, NM 87545
(505) 667-3901

Mr. Paul W. Mahlstedt
BETAC Corporation
1401 Wilson Blvd.
Arlington, VA 22209
(703) 522-6942
TELENET-TELEMAIL
p.mahlstedt/cpi
FAX: 703-247-0450

Dr. William L. Maloy
NETPMSA, Code 04
Pensacola, FL 32509-5000
(904) 452-1757
FAX: (904) 452-1299

Mr. Michael Michalski
AT&T (7th Floor)
15 West 6th Street
Cincinnati, OH 45202
(513) 352-8668
ATTmail!mmichalski
FAX: (513) 352-5797

Dr. Michael G. Moore
Associate Professor of Education
Pennsylvania State University
219 Rackley Bldg.
University Park, PA 16802
(814) 863-3764
(814) 865-3387
BITNET NOG at PSUVM
FAX: (814) 865-3315

Ms. Janelle E. O'Dell
Director of Public Relations
University of the World
1055 Torrey Pines Rd., Suite 203
La Jolla, CA92037
(619) 456-0103
millerj@sdsc.bitnet

Mr. Joseph V. Paska
Triton Systems Corporation
9300 Lee Highway
Fairfax, VA 22031-1207
(703) 934-3900/3956

Dr. Nancy N. Perry
NETPMSA, Code 047
Pensacola, FL 32509-5000
(904) 452-1288
perry@NPRDC
FAX: (904) 452-1296

Dr. Ruth H. Phelps
Army Research Inst. Field Office
1910 University Dr.
Boise, ID 83712
(208) 334-9390
phelps@alexandria-emh2.army.mil

Dr. Farhad (Fred) Saba
Assoc. Prof. of Ed. Technology
San Diego State University
Dept. of Educational Technology
College of Education
San Diego, CA 92182-0311
(619) 594-6138

Dr. Arthur L. Slater
NETPMSA, Code 0412
Pensacola, FL 32509-5000
(904) 452-1309

Dr. David E. Stone
Computer Teaching Corporation
1713 S. Neil Street
Champagne, IL 61820
(217) 352-6363
FAX: (217) 352-3104

Dr. Mary S. Trainor
Los Alamos National Laboratory
A-6, MS M997
Los Alamos, NM 87545
(505) 667-7862

Brig. Gen. Charles R. White
U.S. Air Force Reserve
200 Bibb Ave.
Auburn, AL 36830
(205) 844-1414

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